Phase II Ecological Assessment for the Buffalo Lake, River, and Trails Candidate Area

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EXECUTIVE SUMMARY

The K'átł'odeeche First Nations brought forth the Buffalo Lake, River, and Trails (BLRT) Candidate Area initiative through the NWT Protected Areas Strategy (PAS). Environment and Natural Resources (ENR), Government of the Northwest Territories (GNWT), is working in cooperation with the K'átł'odeeche First Nations, in overseeing the ecological assessment of the Buffalo Lake Candidate Area (BLCA) as described in Step 3 of the PAS. This ecological assessment requires a detailed inventory of key ecological components of the BLCA. This information is required to determine species diversity and distribution to ensure that the candidate area captures a range of successional stages, wildlife habitat, self-sustaining land and water systems, and sensitive/rare species. In this way, the candidate area's contribution to the ecological representation of these components and processes at a regional scale can be assessed. Such an understanding would also form a cornerstone of future management planning for the area.

The BLCA is dominated by the Buffalo Lake and River, but also includes the Yates and Whitesand Rivers that produce a fertile delta as they flow into the Buffalo Lake. A vegetation survey was conducted on the area identifying 16 plant communities, of which ten were assessed on the ground. Sixty-six plant species and 28 families of vascular plants were observed in the BLCA over three days of surveying. Six plant families accounted for over 50% of the species total and in descending were: Salicaceae, Ericaceae, Cyperaceae, Rosaceae, Betulaceae, and Pyrolaceae.

During field surveys, 74 different bird species were observed including actual sightings, bird calls or sign. Nine of the most frequently seen bird species observed, in order of frequency of occurrence, include: sandhill crane, bald eagle, bufflehead,

mallard, Canada goose, scaup (assumed to be lesser scaup), northern harrier, swamp sparrow and northern shoveler. Breeding bird surveys were conducted in 11 of the plant communities identified in the BLCA. The highest number of bird species (greater species richness) was observed in the wetland and mixed forest communities, while the tall shrub (closed canopy) had the least richness.

A waterfowl survey was conducted around the perimeter of the part of Buffalo Lake outside Wood Buffalo National Park (WBNP), Yates River, Whitesand River, and ponds in northeast portion of study area. A total of 105 waterfowl observations were documented representing 12 different species. The six most common waterfowl species were mallard, bufflehead, lesser scaup, Canada goose, northern shoveler, and American widgeon.

Twelve species of wildlife were observed within the BLCA during fieldwork conducted for this Phase II Ecological Assessment, with black bears and moose being the most common sightings. During a moose survey conducted on an area larger than simply the BLCA but encompassing the entire study area, an average density of 5 moose/100 km^2 was calculated.

An intensive survey of muskrat push-ups was conducted on the southern shore of Buffalo Lake, where the Yates and Whitesand Rivers enter into Buffalo Lake. This area was identified as being good muskrat habitat. After conducting a reconnaissance flight to identify where the muskrat push-ups were concentrated, a smaller study area of approximately 390 km^2 was intensely surveyed and 436 muskrat push-ups were observed. Of these muskrat push-ups, 94 (or 22% of the total) were observed on a medium sized lake nicknamed 'Muskrat Lake' with an additional 15 push-ups observed

in a river, which was presumed to flow into 'Muskrat Lake', bringing the total to 105 muskrat push-ups (or 25% of the total) found on this one water body.

Field work conducted in the BLCA has filled some gaps identified in the Phase I Ecological Assessment (Crosscurrent Associates Ltd. and Maskwa Environmental Services Ltd. 2007), while providing some needed baseline information for the region. Important habitat for a variety of species was identified, including some areas outside the boundary of the study area that has been identified as being important for boreal woodland caribou (boreal caribou). The Buffalo Lake Working Group will consider the information from this assessment, as well as information from the other assessments conducted for the BLCA, and will make decisions on how to protect this area, and what boundaries and management actions are required to protect the identified values.

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INTRODUCTION

The Buffalo Lake, River, and Trails Candidate Area (herein referred to as BLRT) in the Dehcho Region of the southern Northwest Territories (NWT) (Figure 1) arose in December 2003 when the K'átł'odeeche First Nation (KFN) began the process for permanently protecting this area of great ecological and cultural importance to their community. The area is considered important for moose, waterfowl, and fish. Under the Dehcho Interim Measures Agreement, the BLRT was protected from new development until October 2011 to allow for further assessment of the area in the absence of any further land dispositions beyond those already existing in the area. The area was defined within the Draft Dehcho Land Use Plan as Conservation Zone 15 and is 2,177 km^2 in size (Dehcho Land Use Planning Committee 2008).

The Department of Environment and Natural Resources (ENR) is overseeing an ecological assessment of the Buffalo Lake Candidate Area (BLCA) as described in the NWT Protected Area Strategy (PAS). An ecological assessment of BLRT requires an inventory of the candidate area's key ecological components. This information is used to determine species diversity and distribution, which helps the Buffalo Lake Working Group make decisions on final boundaries and future management planning for the area. In addition, it helps assess the candidate area's contribution to ecological representation at a regional scale.

This report is the result of a Phase II Ecological Assessment for BLRT. The Phase I Ecological Assessment (Crosscurrent Associates Ltd. and Maskwa Environmental Services Ltd. 2007) identified a few gaps in the available information that included a need for further in-depth bird surveys, including breeding birds and waterfowl, to augment the relatively sparse and dated data from the 1940s. The Phase I report also described a gap in specific knowledge of plant communities in the area, in particular the

lack of information on rare plants. In addition to these findings, community input from the local communities stated concern over the muskrat population in the area, which has limited study in the region, and moose populations, which had not been previously surveyed. This report attempts to provide information to fill these gaps and provide valuable information to stakeholders as this site moves through the PAS.

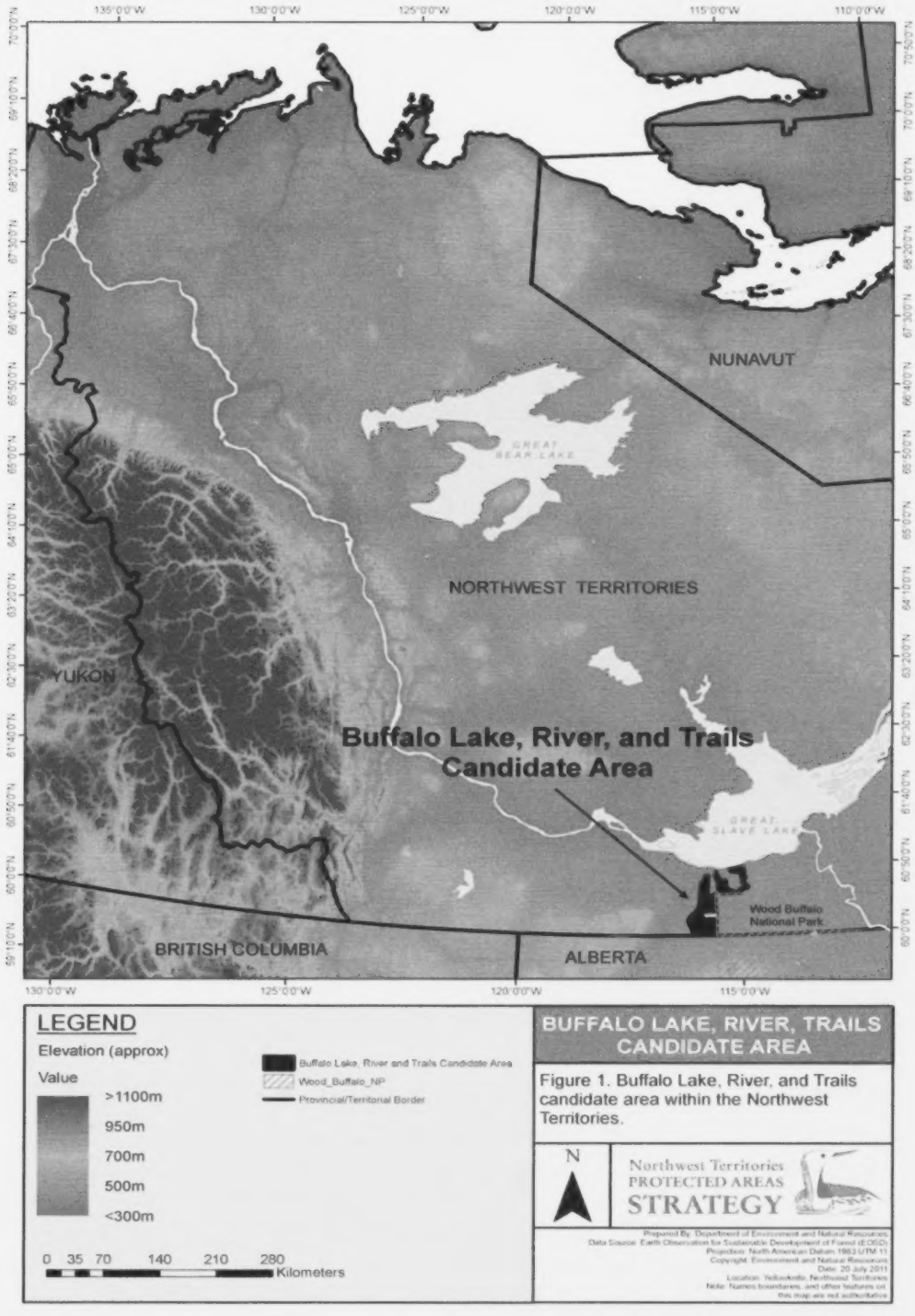


Figure 1. Buffalo Lake, River, and Trails Candidate Area within the NWT.

Objectives

The objective of this study was to augment the existing biological data collated in the Phase I Ecological Assessment (Crosscurrent Associates Ltd. and Maskwa Environmental Services Ltd. 2007). A current inventory of the breeding birds, waterfowl and vegetation of the BLCA was conducted, based on as broad a sampling program as possible within the temporal and financial limits of the study.

This was accomplished through direct observation of the plants and animals, bird surveys, and aerial reconnaissance. Specific aspects of the inventory included:

- plant community classification and description;
- breeding bird surveys;
- waterfowl surveys;
- identification of localized areas of significance such as waterfowl staging areas, raptor territories/nests, etc.;
- photograph categorization of plant communities and special features;
- incidental observations of other wildlife; and
- species list of plant, bird and mammal species observed, augmented by a hypothetical species list based on relevant literature.

Study Area

The BLCA is situated in the southern NWT, adjacent to the WBNP. The study area surrounds the section of Buffalo Lake that is not within the current boundaries of Wood Buffalo National Park (WBNP), and includes the Yates and Whitesand Rivers. This area also encompasses traditional trails from Buffalo Lake to the Hay River Reserve, home of the K'átł'odeeche First Nation, and follows the Lower Buffalo River as it flows from the boundaries of the WBNP to Great Slave Lake, while including an area with a high density of ponds in the northern portion of the candidate area.

Within the Taiga Plains Ecoregion (Ecosystem Classification Group 2007), the BLCA lies within the Tathlina Plain Mid-Boreal (MB) and the Great Slave Lowland MB Type IV Ecoregions.

The Tathlina Plain MB Ecoregion is dominated by peatlands and has some islands of forests on drier terrain and along water bodies. The dominant vegetation in this ecoregion is open and closed black spruce (*Picea mariana*) stands with scatter larch/tamarack (*Larix laricina*) in poorly drained soils. On peat plateaus, the drier raised areas support open black spruce stands with lichen and northern Labrador tea (*Ledum palustre*) ground cover, while along the collapse scars, the areas around the plateaus where the permafrost is melted result in wetter environments, consisting primarily of sedges (*Carex* spp.), cottongrass (*Eriophorum* spp.), and peat mosses (*Sphagnum* spp. and *Drepanocladus* spp.). Northern ribbed fens are composed of larch/tamarack and black spruce stands with sedge groundcover. Areas that are better drained support mixed forests of jack pine (*Pinus banksiana*), white spruce (*Picea glauca*), and black spruce with low shrub and lichen groundcover. Watercourse banks are dominated by mixed and single stands of trembling aspen (*Populus tremuloides*), balsam popular

(*Populus balsamifera*), white spruce, and black spruce. A notable feature of this ecoregion is the presence of alvars, unique vegetation communities, including uncommon grasslands more typical of dry areas further south, associated with thin soil layers of limestone pavements (Ecosystem Classification Group 2007). No alvars were documented within the study area; however, they do occur commonly on the higher, drier sites to the west and northwest of the study area's boundaries.

The Great Slave Lowland MB Ecoregion is mostly flat with northern ribbed fens, net fens, and horizontal fens and has islands of mixed forests on drier terrains. The ecoregion consists mostly of treed, shrubby and sedge-dominated fens that are frequently flooded in low-lying areas. In drier more elevated areas with coarse soils, forests consist of jack pine and some mixed forests of jack pine and trembling aspen depending upon stand age, with ground cover consisting of sparse shrubs, forbs and lichen. Areas with mixed textured soils have single species and mixed forests of trembling aspen, black spruce, white spruce, balsam poplar and paper birch (*Betula papyrifera*), with ground cover consisting of low-bush cranberry (*Vaccinium vitis-idaea*), prickly rose (*Rosa acicularis*), green alder (*Alnus viridis*) and forbs. Similar to the Tathlina Plain MB Ecoregion, peat plateaus form complexes between open black spruce stands with northern Labrador tea, common Labrador tea (*Ledum groenlandicum*), and lichen groundcover and collapse scars with sedge, cotton grass, and peat moss, mostly found north of Mills Lake in the centre of the ecoregion. Notable features are saline sulphur springs, known rare plants, and alvars (Ecosystem Classification Group 2007).

Limited biological research has been conducted in the study area. In 2007 the K'átł'odeeche First Nation commissioned a Phase I Ecological Assessment, which included an initial review of literature of existing biological information for the BLCA (Crosscurrent Associates Ltd. and Maskwa Environmental Services Ltd. 2007). The

Phase I report consisted of a description of the study area, including the physical landscape and a description of the current land uses, and an ecological assessment of the terrain and soils, hydrology, ecological disturbances, vegetation, and wildlife. It also included recommendations for further research to identify data gaps that included the need to conduct waterfowl, bird and rare plant surveys in the study area.

Although there has been considerable botanical work completed across the NWT, including collection sites adjacent to BLCA, only a few collections and studies have been made within the study area. Most of the earlier collections were along the western boundary of the study area (Porsild and Cody 1980). Vegetation mapping of the general Pine Point area was first undertaken in 1977 using black and white aerial photographs and fieldwork (BC Research 1983). Additional mapping of the area was carried out in 1979 by Beak Consultants Ltd. (Beak Consultants Limited 1980). An ecological land classification (EBA 2005a) and rare plant survey (EBA 2006a) were conducted in the area of Pine Point (EBA 2005a, 2006a).

Fisheries and Oceans Canada (DFO) have conducted fisheries work in the region, including Buffalo Lake and River, Yates and Whitesand rivers, in the past and have documented that inconnu (*Stenodus leucichthys*), yellow pickerel (*Sander vitreus*), lake whitefish (*Coregonus clupeaformis*), burbot (*Lota lota*), and northern pike (*Esox lucius*) commonly occur (Smith and Taptuna 2007). Fau (1975) prepared a report for WBNP that included a basic fish survey in Buffalo Lake. Griffiths and Ferster (1974) conducted a preliminary fisheries survey of the Bistcho Lake-Steen River region in Alberta (AB), but also included additional rivers such as Yates and Hay Rivers. Day and Low (1993) conducted a study on the inconnu fishery at the mouth of the Buffalo River.

Wildlife surveys were first conducted at the Pine Point Mine site by BC Research between 1976 and 1980 on behalf of Cominco Ltd. (BC Research 1983). Between 2005 and 2008 EBA conducted a number of environmental baseline surveys in the region of Pine Point including the following: water quality, stream assessment (including fisheries), ecological land classification, wildlife and wildlife habitat use surveys were conducted in 2005 (EBA 2005a, and 2005b respectively); rare plant, breeding bird, amphibian and owl surveys, and water quality sampling were conducted in 2006 (EBA 2006a, 2006b, and 2006c, respectively); and yellow rail surveys were conducted in 2008 (EBA 2008).

Ducks Unlimited Canada conducted waterfowl surveys in the region of Buffalo Lake in 2006 and 2007 (Crosscurrent Associates Ltd. and Maskwa Environmental Services Ltd. 2007). ENR has been conducting on-going boreal woodland caribou (boreal caribou) studies for a number of years in the study area; as well, ENR conducts regular bison surveillance patrols in the Bison Control Area (BCA) (bison free zone).

VEGETATION

Methodology

Based on the Earth Observation for Sustainable Development (EOSD) land cover classification (Natural Resources Canada 2006, Wulder et al. 2004) for the study area, 16 terrestrial plant community types were identified (Figure 2). Table 1 presents the coverage of each of the plant communities in hectares (ha) of the study area. Of note, 68% of the study area consists of three community types, namely shrubby wetland (32%), low shrubs (25%), and dense coniferous forest (11%). Water represents the fourth largest cover at 10%.

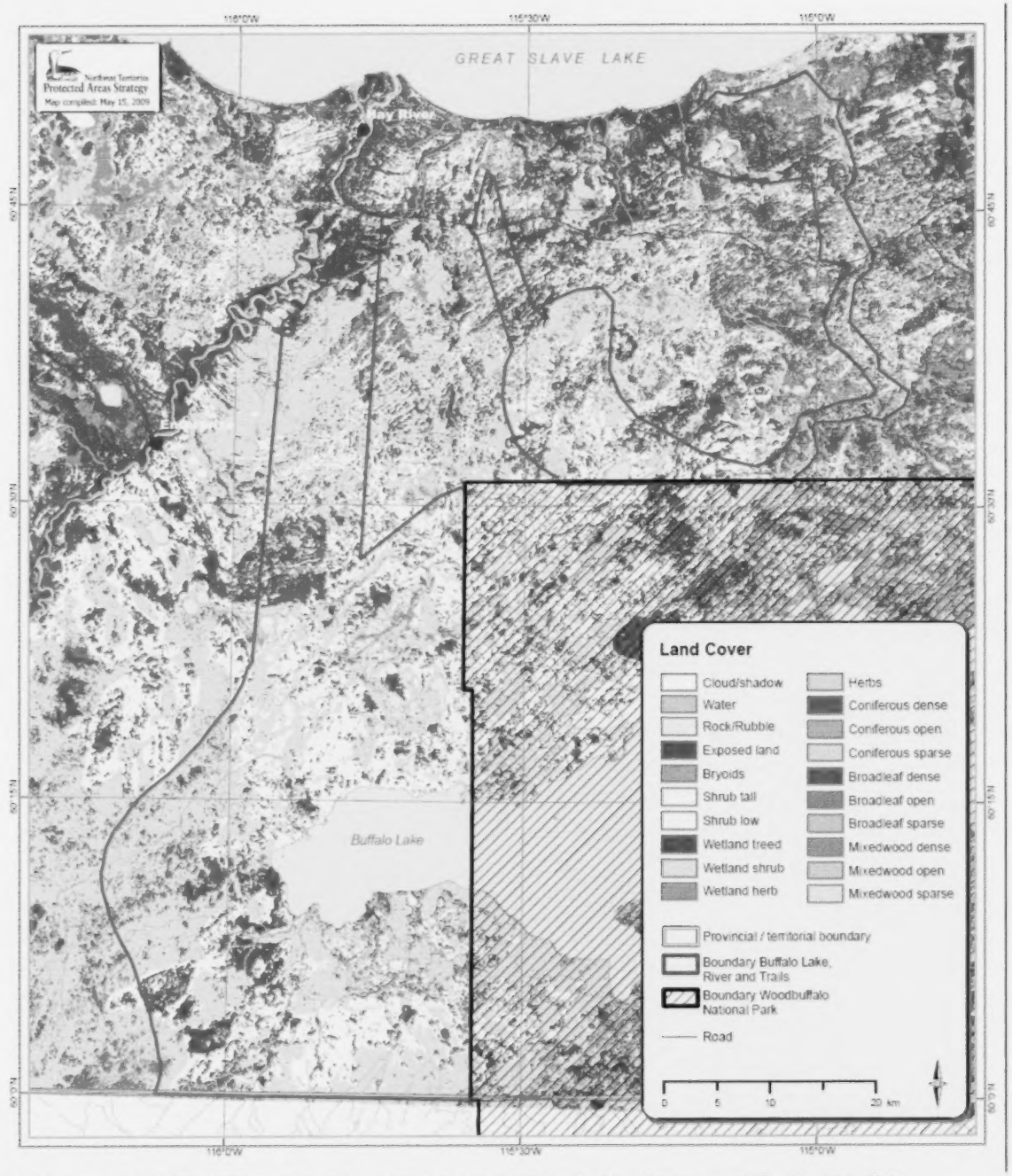


Figure 2. NWT land cover classification for the Buffalo Lake, River, and Trails Candidate Area.

Table 1. Composition of the study area according to 16 land cover classification and other identified features (water, exposed land and cloud/shadow).

Vegetation Cover[1]	Area (ha)	%
Wetland - shrub	70,496.31	32.36
Shrub - low	53,721.00	24.66
Coniferous - dense	23,208.56	10.66
Wetland - treed	15,195.31	6.98
Broadleaf – dense	11,971.50	5.50
Wetland - herb	7,447.31	3.42
Shrub - tall	5,129.44	2.35
Coniferous - open	3,254.69	1.49
Coniferous - sparse	2,603.06	1.20
Broadleaf – open	1,074.00	0.49
Mixed wood – open	167.63	0.08
Broadleaf – sparse	161.88	0.07
Mixed wood – sparse	97.38	0.04
Herbaceous	56.06	0.03
Bryoids	30.13	0.01
Mixed wood – dense	2.88	0.00
Water	22,486.63	10.32
Exposed land	636.06	0.29
Cloud/shadow	75.50	0.03
TOTAL Area (ha)	217,815.33	100

[1] Vegetation cover for the study area based on EOSD classification (Natural Resources Canada 2006, Wulder et al. 2004).

Based on this information, sampling sites were chosen with an attempt to sample each plant community type proportionally to their coverage within the study area. A total of 18 plant community sampling sites were sampled, located within 12 of the 16 plant community types (Figure 3). Each site was located in a relatively homogenous polygon of a particular plant community type on the satellite image of the study area. Universal Transverse Mercator (UTM) grid coordinates of each site were determined by GIS, which were used to navigate to the site using a handheld Global Positioning System (GPS) unit. Sampling sites were accessed between 1-5 June, 2009 by helicopter due to the remoteness of the area. A majority of the ground surveys were conducted between 4 a.m. and 10 a.m., to accommodate the auditory breeding bird surveys. The air

temperature varied quite a bit during this time of day, from a low of 8°C to a high of 18°C on the first day and a low of -3°C (frost) to a high of only 5°C on the final day of survey. These temperatures, as well as those in the month previous, were generally lower than normal for this time of year (Figure 4).

Plant community descriptions included the following: site number and location, UTM coordinates using a GPS, date, topographic position, slope, aspect, canopy and ground cover, moisture regime, texture of surficial deposits, landform, elevation, plant species, and animal signs. Moisture regime was subjectively ranked following Walmsley et al. (1980). Elevation was determined from topographic maps. Percent coverage of trees and shrubs were visually estimated. Select tree heights were measured with a clinometer. An attempt was made to identify all vascular plants at each site. Representative samples were collected for species that were difficult to identify in the field such as willows, sedges and grasses. These were identified under magnification with the aid of taxonomic guides (Argus 1973, Burt 1991, Cobb 1963, Cody 2000, Courtenay and Zimmerman 1972, Douglas 1982, Johnson et al. 1995, Moss 1977, Porsild and Cody 1980, Scotter and Flygare 1986, Trelawny 1983). A series of photographs were taken depicting the most representative aspects of a given community type (APPENDIX B).

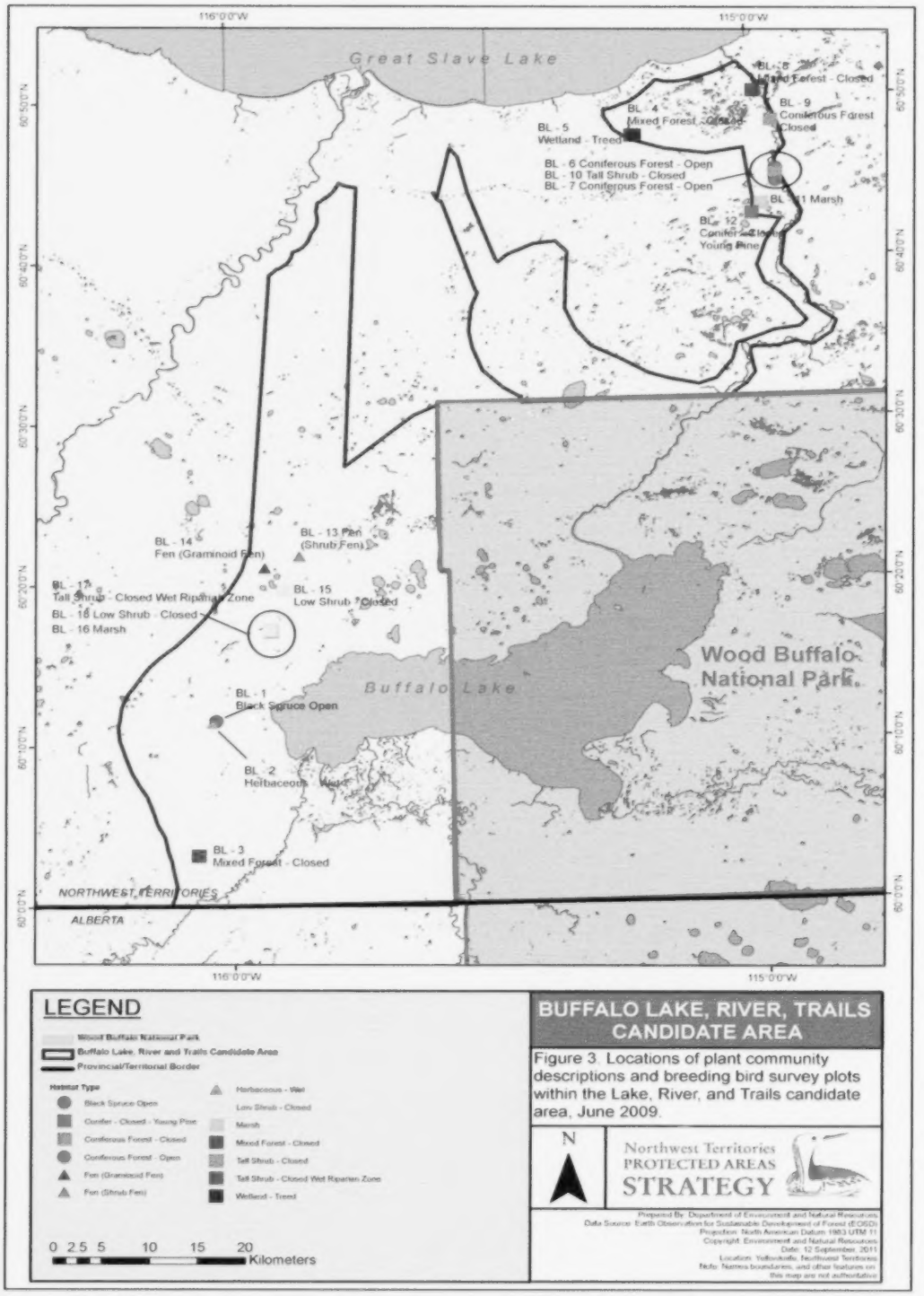


Figure 3. Location of plant community descriptions and breeding bird survey plots within the Buffalo Lake, River, and Trails Candidate Area, June 2009.

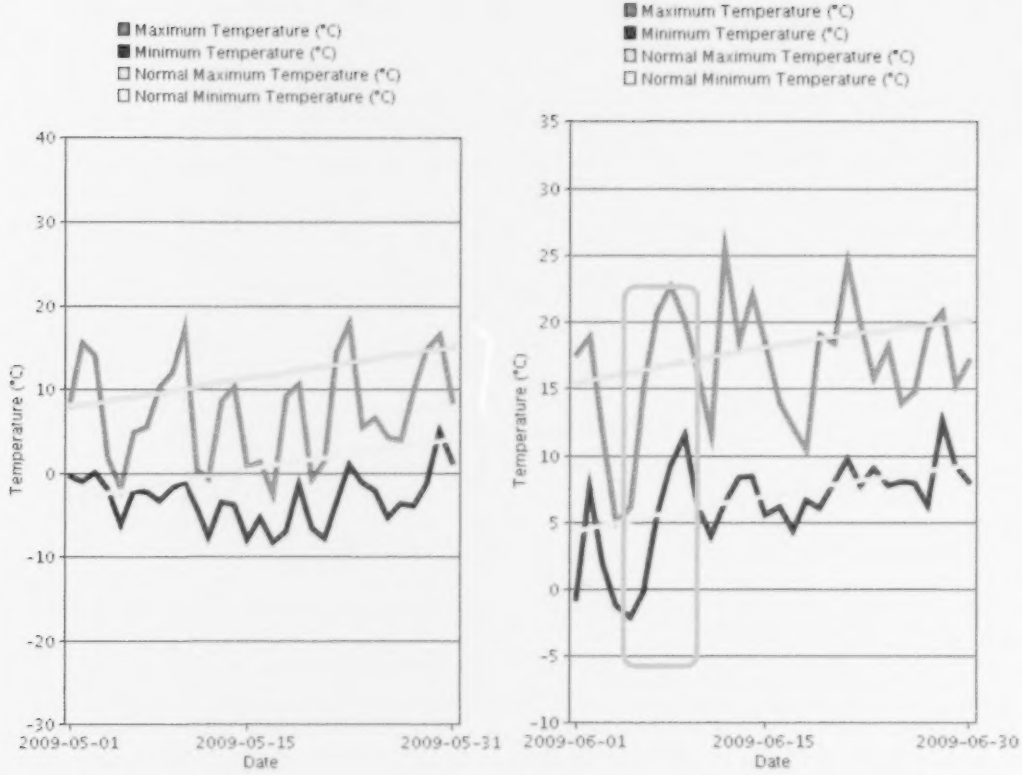


Figure 4. Observed minimum and maximum air temperatures with normal minimum and maximum air temperatures during May and June 2009 for Hay River, NWT. Chart and data courtesy of Environment Canada. The pink box represents the days of the survey from 1-5 June, 2009.

RESULTS

Plant Communities

The plant classification was further refined with the additional ground survey. Table 2 shows how the adjustments fit within the original classification scheme and the resulting ten plant communities, including marsh which was not detected and/or classified in the land cover classification however was found in the study area.

Table 2. Plant communities described in this study and the corresponding Land cover classification.

EOSD Land Cover Classification[1]	Vegetation Classification for Plant Community Descriptions[2]
Bryoids	Not Assessed[4]
Shrub - tall	Tall Shrub
Shrub - low	Low Shrub
Wetland - treed	Fen – Treed
Wetland - shrub	Fen – Shrub
Wetland - herb	Fen – Graminoid
Herbaceous	Not Assessed[4]
Coniferous - dense	Jack Pine Closed Canopy and White Spruce Closed Canopy
Coniferous – open	Black Spruce Open Canopy
Coniferous – sparse	Not Assessed[4]
Broadleaf – dense	Not Assessed[4]
Broadleaf - open	Not Assessed[4]
Broadleaf – sparse	Not Assessed[4]
Mixed wood - dense	Mixed Forest Closed Canopy
Mixed wood - open	Not Assessed[4]
Mixed wood - sparse	Not Assessed[4]
(Marsh)[3]	Marsh

[1]Land cover classification used for the study area.
[2]Vegetation classification used for plant community descriptions. Classification is based on ground observations.
[3]The EOSD Land Cover Classification did not detect and/or classify the marsh community type, presumably because of its limited coverage.
[4]Not Assessed. Not all communities could be assessed between 3-5 June, 2009 due to time constraints and/ or site accessibility.

A total of 18 site assessments were conducted in ten plant communities in 2009 (Table 3). Common names of plant species are used in the descriptions; for species

without common names, Latin nomenclature was used. Plant species nomenclature follows current standards (Working Group on General Status of NWT Species 2011). In a few cases where plant names were not listed by ENR, the nomenclature followed Cody (2000), followed by Porsild and Cody (1980). By convention, the common names of fish and bird species typically begin with capital letters, whereas plants and mammals use lower case letters. In some cases, the genus name is used as a common name with the first letter capitalized. These conventions were followed in this report. A full listing of plant species observed is provided in APPENDIX A and site photographs of the plant communities visited is provided in APPENDIX B.

Table 3. Vegetation plots completed per plant community type.

Vegetation Classification for Plant Community Descriptions (EOSD Classification)	Number of site assessments
(Bryoids)[2]	---
Tall shrub closed (shrub tall)	2
Low shrub closed (shrub low)	3
Fen – treed (wetland treed)	1
Fen – shrub (wetland shrub)	1
Fen – graminoid (wetland herb)	1
(Herbs)	---
Jack pine closed canopy (coniferous dense)	1
White spruce closed canopy (coniferous dense)	2
Black spruce open canopy (coniferous open)	2
(Coniferous sparse)	---
(Broadleaf dense)	---
(Broadleaf open)	---
(Broadleaf sparse)	---
Mixed forest closed (mixed wood dense)	3
(Mixed wood open)	---
(Mixed wood sparse)	---
Marsh[1]	2
TOTAL	**18**

[1]The EOSD Land Cover Classification did not detect and/or classify the marsh community type, presumably because of its limited coverage.
[2]Not Surveyed.

White spruce closed canopy

The 'white spruce closed canopy' community type is characterized by its mature tree stratum, having a continuous occurrence of white spruce with a canopy closure

greater than 40% (APPENDIX B: Photographs 18-20). The tree stratum comprises of 100% white spruce (9-12 m in height) with a few individual trembling aspens (7 m). The shrub stratum contain a variety of species, which included prickly rose, buffalo-berry (*Shepherdia canadensis*), common juniper (*Juniperus communis*), shrubby cinquefoil (*Dasiphora fruticosa*), red osier dogwood (*Cornus sericea*), red bearberry (*Arctostaphylos rubra*), and squashberry (*Viburnum edule*); while the herb stratum contain species such as lesser pyrola (*Pyrola minor*) and one-sided wintergreen (*Orthilia secunda*). Ground cover includes 98% moss cover. Moisture regime was mesic to sub-mesic with good drainage.

Two white spruce closed canopy sites were surveyed representing two different climax stages, i.e. one being more mature. Both sites were similar with a few key differences. Canopy height of the younger site was 9 m with <5% deciduous (trembling aspen) trees and a mesic moisture regime. The older site had a 12 m canopy with <1% deciduous trees, paper birch, and a sub-mesic moisture regime. The older site also had a few additional ground species that were not represented in the younger site, i.e. rock cranberry (*Vaccinium vitis-idaea*), dwarf scouring-rush (*Equisetum scirpoides*), and old man's beard (*Usnea* spp.), an arboreal lichen.

Black spruce open canopy

The 'black spruce open canopy' community type is characterized by a mature tree stratum having a discontinuous occurrence of black spruce with a canopy closure between 10-40% (APPENDIX B: Photographs 21-23). Two sites were surveyed, one located on mid-slope and the second site on a palsa bog. Site moisture regime was typified by sub-mesic conditions with moderate drainage.

Trees are smaller in the black spruce community type than white spruce, averaging 6 m or less in height. The shrub stratum varies depending on site conditions with the common species represented by common Labrador tea, Arctic dwarf birch (*Betula nana*), alpine bilberry (*Vaccinium uliginosum*), buffalo-berry, gray willow (*Salix glauca*), and shrubby cinquefoil (*Dasiphora fruticosa*).

On the drier areas, red bearberry (*Arctostaphylos rubra*), common bearberry (*Arctostaphylos uva-ursi*), common juniper and creeping juniper (*Juniperus horizontalis*) grew; while blueberry willow (*Salix myrtillifolia*) grew on wetter areas. The shrub stratum is well represented consisting of two layers: tall willows and birches, and low Labrador tea, bearberry, and cranberry. Shrub height varied between 1-1.5 m depending on a given site. Ground cover is moss-lichen composition.

Jack pine forest

The 'jack pine (*Pinus banksiana*) forest' community type is common within the study area, particularly in the southern half; and to a lesser degree, in the northern portion of the study area, north of the Highway #5. Jack pine occurs in two ecosystem types in the study area. It is the dominant tree species in the jack pine–lichen woodland that occurs on elevated ground with rocky substrate and on very well drained sandy sites (primarily eskers). It is also a seral tree species that establishes after fire in the spruce–lichen woodland, where it is eventually overtaken by spruce as the stand matures. Within this study, stands of jack pine were seen growing on all those sites but only one assessment was completed, that being a burned spruce–lichen community that was regenerating as a pure jack pine stand.

The jack pine stand assessed is a young closed canopy community. It is characterized by its continuous occurrence of young jack pine and closure is >40%

(APPENDIX B: Photographs 16, 17). Trees averaged 4 m in height with a diameter at breast height of approximately 9.5 cm. The tree stratum is composed of 100% jack pine while shrubs were represented by common bearberry, red bearberry, buffalo-berry, squashberry, gray willow, prickly rose, and common juniper. Forbs were represented by one-sided wintergreen, mountain death camas (*Zigadenus elegans*), and slender wood reed grass (*Cinna latifolia*). Ground cover includes various lichens/mosses. Ground drainage was good with a moisture regime of sub-xeric. The presence of jack pine is the result of a forest fire and represents an intermediate seral stage.

Mixed forest closed canopy

This 'mixed forest' community type contains two or more species of trees; no individual species can represent more than 75% of total canopy coverage (APPENDIX B: Photographs 24-27). This type of stand represents an intermediate seral stage of what will become a white spruce climax forest, if left unburned. This community is typically dominated by white spruce in mature stands (open and closed canopies) with secondary components of paper birch and trembling aspen. Three mixed forest sites were assessed representing different seral stages: jack pine/aspen, white spruce/aspen, and aspen/white spruce. For all sites, tree heights for the conifer species averaged between 9.5-12.5 m, while the deciduous species averaged 8-10 m in height. Balsam poplar was recorded on the jack pine/aspen site. These trees were mature and slowly being crowed out by the jack pines.

The dominant tall shrubs include willow (*Salix candida, Salix planifolia,* and *Salix scouleriana*), while lower growing shrubs are represented by common Labrador tea, prickly rose, woods rose (*Rosa woodsii*), buffalo-berry, rock cranberry, and squashberry. As the seral stage advances in age, the canopy closure increases and shrubs occupy a relatively less dominant position within the site as the sun's energy is reduced. Other

species commonly occurred but had low relative dominance, and included, in order of dominance, twinflower (*Linnaea borealis*), running clubmoss (*Lycopodium clavatum*), bare-stem bishop's cap (*Mitella nuda*), one-sided wintergreen, dwarf dogwood (*Cornus canadensis*), pink pyrola (*Pyrola asarifolia*), Arctic pyrola (*Pyrola grandiflora*), northern bedstraw (*Galium boreale*), and calypso (*Calypso bulbosa*).

Tall shrub

The distinguishing characteristic of 'tall shrub closed canopy' community type is the high proportion of shrub species compared to trees or herbaceous plants. Tall shrub communities are common along the larger rivers such as the Buffalo, Yates, and Whitesand rivers, and along the shoreline of Buffalo Lake (APPENDIX B: Photographs 3-5). Willow is the dominant shrub type.

Tall shrub closed canopy community types are unique and uniform in their habitat. This community is characterized by an extensive shrub stratum growing to 2 m in height containing willow, alder, and balsam poplar with no trees. Canopy closure is >40%. The herb stratum is more extensively developed than in forested community types. This site is heavily impacted by flood waters and ice-gouging during spring runoff. Ground cover includes an herbaceous-moss composition and may be well developed or considerably flooded with the water table at or above ground level. Site moisture regime was typified by mesic to hydric conditions. The majority of sites are associated with a high water table and are restricted to riparian zones and wet areas.

The herbaceous layer's relative dominance was greater than in the forested communities and was represented by the following species: Siberian yarrow (*Achillea sibirica*), blue columbine (*Aquilegia brevistyla*), blue-jointed reed grass (*Calamagrostis canadensis*), Virginia strawberry (*Fragaria virginiana*), northern bedstraw (*Galium*

boreale), Arctic pyrola (*Pyrola grandiflora*), black-tip ragwort (*Senecio lugens*), and common dandelion (*Taraxacum officinale*). Ground cover consisted of grass, gravel and detritus.

Low shrub

The 'low shrub closed canopy' community type (APPENDIX B: Photographs 6-9) shows greater variation in community characteristics than the tall shrub community type, and is the result of fire history, soil characteristics or the moisture regime. Field investigations revealed that low shrubland closed canopy communities occurred under a wide range of site conditions that included slopes, riparian zones and peat plateau bogs. Each site possessed unique characteristics generating distinctive plant communities. Three low shrub communities were assessed and all occurred on peat plateau bogs. These sites are the result of earlier forest fires and represent young seral stages, which will eventually become white spruce forests.

Low shrub closed canopy sites are characterized by shrubs <1.5 m in height with a canopy closure >40%. Trees are usually present, although in low numbers, and appear as individuals and not in clusters; their growth form is typically characterized as being atypical. Trees had varying heights, representing multiple age classes. Regenerating white spruce is the dominant tree species, with jack pine, tamarack and paper birch represented but occurring in low numbers.

The shrub stratum consists of one dominant and one subdominant species, either birch or willow depending on site conditions and age. Common Labrador tea is the dominant shrub occurring on peat plateau bogs. Willows were not present on the sites sampled. Shrub height varied between 0.75-1.5 m. Canopy closure is >60% but variable depending on the site. Additional shrubs present include bog rosemary (*Andromeda*

polifolia), water birch (*Betula occidentalis*), leatherleaf (*Chamaedaphne calyculata*), narrow-leaved Labrador tea (*Ledum palustre* ssp. *decumbens*), small cranberry (*Vaccinium oxycoccus*), and rock cranberry.

Although an herbaceous stratum was present, its relative dominance was low. Characteristic herbaceous species for a low shrub closed canopy community type varied depending upon site but included cloudberry and sedge species. Ground cover consisted of lichen and moss. This stratum's depth was highly variable depending on the site.

Moisture regime ranged between sub-mesic to mesic. Ground drainage was variable across all sites.

Wetlands

'Wetlands' are areas where the water table is at the level of the mineral soil for the entire year. These areas are defined along a gradient based on water level fluctuations, extent of water flow, nutrient availability, and rates of growth and decomposition. The following types of wetlands were documented during field investigations: peat plateau bogs, marsh, and three types of fens: treed, shrub and graminoid (sedge) fens.

Peat Plateau Bogs

Organic deposits, known as 'peat plateau bogs', occur in a number of areas. These peatlands are elevated about 1-2 m above the water table and are generally flat with minor surface irregularities. Often these sites contain a surface depression where the water table can be seen, usually near the middle of the site. These bogs contain sphagnum organic material having a slight degree of decomposition. The acidity of sphagnum bogs creates harsh conditions and limits the kind of plants able to survive

there. Typically the bog community consists of plants incapable of growing in alkaline situations.

Dominate vegetation associated with peat plateau bogs are sparse white spruce-lichen with common Labrador tea shrubs. On the edges in the wetter depressions, sedges (*Carex* spp.), cottongrass (*Eriophorum* spp.) and buckbean (*Menyanthes trifoliata*) occur, while cloudberry occurs throughout the site.

Marsh

'Marshes' are wetlands that are periodically inundated by standing or slow-moving water and consequently rich in nutrients. These sites are wet with a humus type of soil that forms on high nutrient silt. Peat formation is minimal. Moisture regime is hydric to sub-hydric. Characteristic plants include emergent vegetation of reeds, rushes, sedges, or grasses. The water level is above the rooting zone for at least a portion of the growing season. The surface water levels of marshes may fluctuate seasonally, and the vegetation often has distinct zones reflecting water depth, fluctuations in water level, and salinity.

The marsh community type (APPENDIX B: Photographs 28-30) has water above the soil surface and occurs along the edges of ponds and lakes, or in the centre of drainage channels. Marshes are typically characterized by zones of distinctive vegetation; with open standing water occurring in the middle and floating vegetation in protected areas followed by zones of cattails, sedges and then shrubs. Marsh vegetation tends to be patchy; the patchiness based in part on water depth and in part on successional processes.

Two marshes were assessed and can be characterized as 40% open water in the middle with 60% broad-leaf cattails (*Typha latifolia*) and soft-stem bulrushes

(*Schoenoplectus tabernaemontani*) around the edges of the water. Progressing outward from the middle, the next zone, represented by shallower water, contained hoary willow (*Salix candida*) and water sedge (*Carex aquatilis*).

Around the edges of the marsh tall shrubs dominated, diamond-leaved willow (*Salix planifolia*) consisting of 10% coverage, intermixed with tamarack trees, with an understory of lower shrubs that included: Arctic dwarf birch, shrubby cinquefoil, common Labrador tea, sweet gale (*Myrica gale*) and rock cranberry.

The dominant vegetation was aquatic sedge (90%) cover and brown mosses (50%). These cover values apply only to the vegetated areas, since up to 50% of the area of this habitat type may be open water. These communities are dominated by a high diversity of emergent plants; thus, contributing to a high diversity of wildlife species, particularly birds.

Fens

Another form of wetlands are 'fens'. They are common throughout the study area representing 43% of all community types, more than twice the amount of coverage than the second largest community type (low shrub). Fens are peatlands characterized by a high water table with slow internal drainage (Johnson et al. 1995), typically restricted to areas of poorly drained organic soils, typified by a drainage network that directs water into channels draining the area. Groundwater is enriched by nutrients from upslope materials, making fens more mineral-rich than bogs.

Fen vegetation reflects the quality and quantity of available water, resulting in three basic types: graminoid (usually sedge) fens, shrub fens, and treed fens. Stand composition varies due to fire regime: early successional stands are dominated by an

open canopy of bog birch, while mature stands have a closed canopy of black spruce and larch.

Treed Fen

The dominant plant for the 'treed fen' community type is tamarack with small quantities of black spruce (APPENDIX B: Photographs 10, 11). The shrub stratum is represented by Arctic dwarf birch, shrubby cinquefoil, gray willow, diamond-leaved willow (*Salix planifolia*), and buffalo-berry up to 1.5 m in height.

This community occurs in areas with some water movement. It has a rich to very rich nutrient regime and a sub-hydric to hydric moisture regime. Tamarack and black spruce form an open canopy with willow, Arctic dwarf birch, and shrubby cinquefoil. The herb layer is diverse, with sedges, dwarf scouring-rush (*Equisetum scirpoides*), bare-stem bishop's cap (*Mitella nuda*), and lesser pyrola (*Pyrola minor*). This community type is the second most common wetland type behind shrub fen, covering approximately 7% of the study area.

Shrub Fen

The 'shrub fen' community type is found throughout the study area and represents the largest unit, approximately 33% of the study area. These fens commonly occur near open water, within larger fen complexes or drainage areas where there is some water movement (APPENDIX B: Photographs 12, 13). They have a medium to rich nutrient regime and a sub-hydric to hydric moisture regime. The shrub fens are often mixed wood, with a canopy of Arctic dwarf birch, sweet gale (*Myrica gale*), littletree willow (*Salix arbusculoides*), shining willow (*Salix lucida*) and blueberry willow, with an understory of tamarack or black spruce as a result of past fires. Sweet gale and sedges are common.

Graminoid Fen

The dominant plant for the 'graminoid fen' community type is water sedge (*Carex aquatilis*), hence the name graminoid fen. Graminoid fens have patterns (ribbons) that are characterized by a series of peat ridges (strings) and hollows (flarks) oriented parallel to the slope of the landform and perpendicular to the flow of groundwater (APPENDIX B: Photographs 14, 15). The ribbons are composed of slightly raised peat ridges and are dominated by sedges, forbs, and small shrubs and include the following species: water sedge (dominant sedge), Arctic dwarf birch, bog rosemary (*Andromeda glaucophylla*), and leatherleaf (*Chamaedaphne calyculata*). Tamarack can also be found growing on the ribbons (the elevated strings of vegetation), occurring from individuals to clusters of trees.

Graminoid fens account for approximately 4% of the study area. They are poorly drained with a hydric moisture regime and a medium nutrient regime. Sedges, reed grass and bulrushes (*Scirpus spp.*) are common. The graminoid fens are often associated with shallow open water and shrub fens. Within the study area, there were many sites that contained both graminoid and shrub fen ecosites. Generally, the shrub fen was dominant, so it is likely that the graminoid fen is under-represented in the study area.

Vascular Plants

Over 200 plant observations were documented during the three days of field studies representing 66 species and 28 families of vascular plants (a list of vascular plant species observed can be found in APPENDIX A). Six plant families accounted for over 50% of the species total (Table 4) and are presented here in descending order based on the number of species represented: Salicaceae, Ericaceae, Cyperaceae, Rosaceae, Betulaceae, and Pyrolaceae.

Table 4. Number of vascular plant species observed in Buffalo Lake, River, and Trails study area.

Plant Family[1]	Number of Species Represented in Each Family	Percent of Species Represented in Each Family
Equisetaceae	1	1.52
Lycopodiaceae	1	1.52
Cupressaceae[2]	2	3.03
Pinaceae	2	3.03
Typhaceae	1	1.52
Poaceae (Gramineae)	2	3.03
Cyperaceae	5	7.58
Juncaceae	1	1.52
Liliaceae	2	3.03
Orchidaceae	1	1.52
Salicaceae	9	13.64
Myricaceae	1	1.52
Betulaceae	4	6.06
Ranunculaceae	1	1.52
Brassicaeae[2]	1	1.52
Droseraceae	1	1.52
Saxifragaceae	1	1.52
Rosaceae	5	7.58
Elaeagnaceae	1	1.52
Cornaceae	2	3.03
Pyrolaceae	4	6.06
Primulaceae	1	1.52
Ericaceae	9	13.64
Scrophulariaceae	1	1.52
Lentibulariaceae	1	1.52
Rubiaceae	1	1.52
Caprifoliaceae	2	3.03
Asteraceae (Compositae)	3	4.55
Total	**66**	**100.09**

[1]Plant families are listed in phylogenetic order.

[2]A number of plant families and species have been reclassified, and in some cases renamed, in recent years. Taxonomic authorities have yet to determine some families' definitive phylogenetic placement. For those families marked with a superscript "2", their arrangement in this table is approximated based on previous phylogenetic order prior to their respective name changes.

BIRDS

The objective for this study was to document bird diversity over a large area; therefore, a range of survey methods were employed for documenting and quantifying the greatest variety of birds (i.e. breeding birds and waterfowl). Survey methods included: plot assessments, breeding bird surveys, waterfowl surveys, and aerial reconnaissance. These survey methods are efficient at gathering the greatest breadth of species information over a large area, within a limited timeframe. Some survey methods (i.e. breeding bird surveys) provided more quantitative data on species abundance within each plant community. Aerial surveys provided qualitative information on waterfowl distribution across the study area. Additional incidental wildlife information on species presence (actual observation, tracks, burrows, browsing sign, and droppings or scat) was collected opportunistically during plant community descriptions and while moving about the study area, either by aircraft or on foot. UTM coordinates were recorded for each observation.

Methodology

Forest bird surveys were conducted 1-5 June, 2009, along with the vegetation surveys described above, during the peak of migration and when most species of boreal forest songbirds are on territory and singing (Bibby et al. 1993, Ralph and Scott 1981, Verner 1985). Forest birds were surveyed using point counts (Ralph et al. 1993) in 11 habitat types.

Point count sites were distributed in approximate proportion to the amount of the habitat type in the study area. For example, if white spruce communities cover 75% of the area, then 75% of the point count sites were within that habitat type. Point count sites were placed a minimum of 100 m from the edge of the habitat type, where possible. Each site was accessed on foot. Surveys commenced at 4 a.m. and continued until 10

a.m. when singing is considered to be the most intense (Ralph et al. 1993). Surveys were curtailed when observation conditions became unsatisfactory due to weather (e.g. wind, constant rain). Particular care was given to not disturb the birds when approaching point count sites. Observers recorded the date, location, weather conditions, basic habitat conditions, and start time before starting a point count. Observers waited a minimum of two to five minutes before beginning each point count to allow birds to resume their normal behaviour. At each point count site, all birds heard and seen within a 100 m radius were noted over a ten minute period. Birds beyond 100 m were noted separately. Birds observed flying over the site were also noted. The species, sex (where possible), and behaviour (flushed, territorial display, etc.) was recorded for each bird observation. Territorial and breeding behaviour was recorded such as territorial calls, displays, distraction behaviour, and disputes. Other information recorded was nest site, anxious parents, incubation, nest building, fledged young, mating, adults carrying food to a nest, and the begging calls of nestlings. Forest birds were also recorded between point counts and during other aspects of the fieldwork.

Forest bird data was analysed for species richness for each plant community, measured as the ratio of the number of species to the number of birds observed in each community.

Waterfowl surveys were conducted around the perimeter part of Buffalo Lake that lies outside of WBNP, Yates and Whitesand rivers, and ponds in the northeast portion of study area. The survey documented species present and their numbers in these wetlands and watercourses. All surveys were conducted by helicopter. Supplemental waterfowl data was also collected during other surveys. Each observation included bird identification to species (with a few exceptions i.e. scaup), sex (where possible), numbers and location. These observations were recorded via GPS.

Results

A species list was developed for species known to occur in the study area, as well as species of hypothetical occurrence. This list was based on range maps in field guides, government reports and research publications. All bird species occurring within a 200 km radius of the study area were included. Field guides were used in generating this list (Dunn 1999, Godfrey 1979, Peterson 1990, Sibley 2003).

A total of 144 different bird species have been listed as occurring, or potentially occurring, in the study area. Bird species were classified as migrant, breeding, transient, resident, accidental or hypothetical. A migrant occurs regularly as it passes through during spring or fall migration. A breeder is a species that breeds in the area and is usually present during the spring, summer and fall. A transient is a species that can occur irregularly at any time of the year. A resident is a species that occurs in the area throughout the year. Hypothetical species is one that could possibly occur in the area based on the proximity of its known range (<200 km), but remains unconfirmed (Appendices C, D).

A total of 300 different bird observations were recorded during this study, comprising 74 different species (Appendices C, D). These observations included actual sightings, bird calls or sign. Nine of the most frequently seen bird species observed, in order of frequency of occurrence, include the following: sandhill crane, bald eagle, bufflehead, mallard, Canada goose, scaup (assumed to be lesser scaup), northern harrier, swamp sparrow and northern shoveler.

More than 250 individual birds were recorded as incidental observations during June 2009. The most common observations were of ducks and geese, followed by sandhill cranes and bald eagles (Figures 6-8).

Additional incidental bird observations considered to be important include those species with special conservation status: American bittern, black tern, common nighthawk, lesser yellowlegs, red-necked phalarope, and rusty blackbird. Table 5 lists those bird species and their respective conservation status.

More detailed results from the breeding bird survey and the aerial waterfowl survey are described below.

Table 5. Bird species documented and hypothetically occurring in the Study Area with special territorial conservation status.

Common Name	Scientific Name	ENR General Status Ranks[4]	COSEWIC Designation
American bittern[1]	*Botaurus lentiginosus*	Sensitive	
Black tern[1]	*Chlidonias niger*	Sensitive	Not At Risk
Lesser yellowlegs[1]	*Tringa flavipes*	Sensitive	
Red-necked phalarope[1]	*Phalaropus lobatus*	Sensitive	
Rusty blackbird[1]	*Euphagus carolinus*	Sensitive	Special Concern
Common nighthawk[1]	*Chordeiles minor*	At Risk	Threatened
Olive-sided flycatcher[1]	*Contopus cooperi*	At Risk	Threatened
Whooping crane[2]	*Grus americana*	At Risk	Endangered
Yellow rail[3]	*Coturnicops noveboracensis*	May Be At Risk	Special Concern
American white pelican[3]	*Pelecanus erythrorhynchos*	May Be At Risk	Not At Risk

[1]Bird species documented within the study area in 2009.
[2]Bird species documented by other researchers (provided by EBA)
[3]Bird species hypothetically occurring in the study area based on range maps or personal expertise and observations in adjacent areas.
[4]ENR General Status Ranks 2011.

Breeding Bird Surveys

Forest bird surveys were conducted between 3-5 June, 2009. A total of 18 point counts (Figure 3) were conducted during which 194 birds were detected during breeding bird surveys, representing 46 species. Two additional species were observed outside the point count sites.

The 18 point counts were conducted in 11 different community types. Of the 11 habitats where point counts were conducted, the marshes had the highest average number of birds observed per point count, while tall shrub and low shrub communities had the lowest number observed.

An index of species richness cannot be reliably applied for the banding bird surveys as the sample size was too small and a late spring could affect the results. The 3.5 days of breeding bird surveys conducted should be viewed as an overview or reconnaissance of bird species occurring within different community types. Consequently, the bird species are presented as the number of species in the community types, which is the oldest and simplest concept of species diversity (Krebs 1989).

The highest number of bird species (greater species diversity) was observed in the wetland and mixed forest communities, while the tall shrub (closed canopy) had the least number (Figure 5). Species diversity considered with species density per point count site indicates that plant communities such as wetlands and mixed forest had relatively high numbers of birds represented with the highest number of species, while communities such as tall shrub and graminoid fen and tall shrub featured low numbers of relatively few species. The marsh community type had the greatest number of bird species and individuals detected (Figure 5). The marsh community type has been removed in Figure 6 to reveal the relative values of the other communities. The shrub fen had a relatively large number of birds detected and is perhaps an aberration as a result of migrating birds or that community type phenologically developing earlier and thus temporarily attracting more individual birds.

The top seven common bird species observed during breeding bird surveys were palm warbler, hermit thrush, swamp sparrow, yellow-rumped warbler, Wilson's warbler, ruby-crowned kinglet, and Le Conte's sparrow.

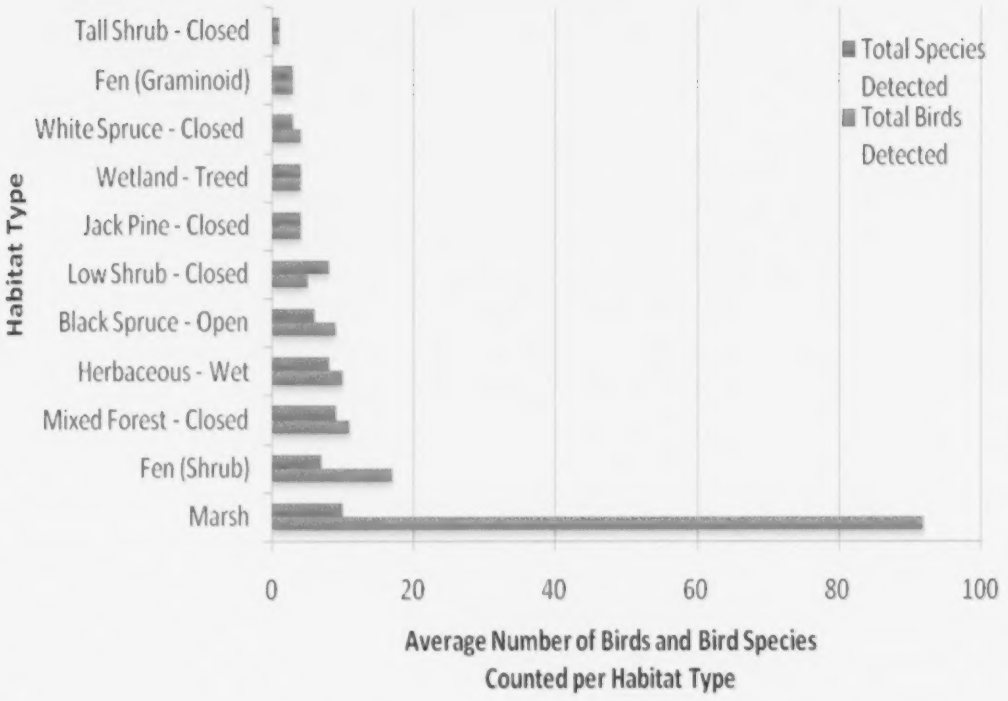


Figure 5. Average number of birds and bird species counted in the 11 habitat types surveyed in Buffalo Lake, River and Trails, June 2009.

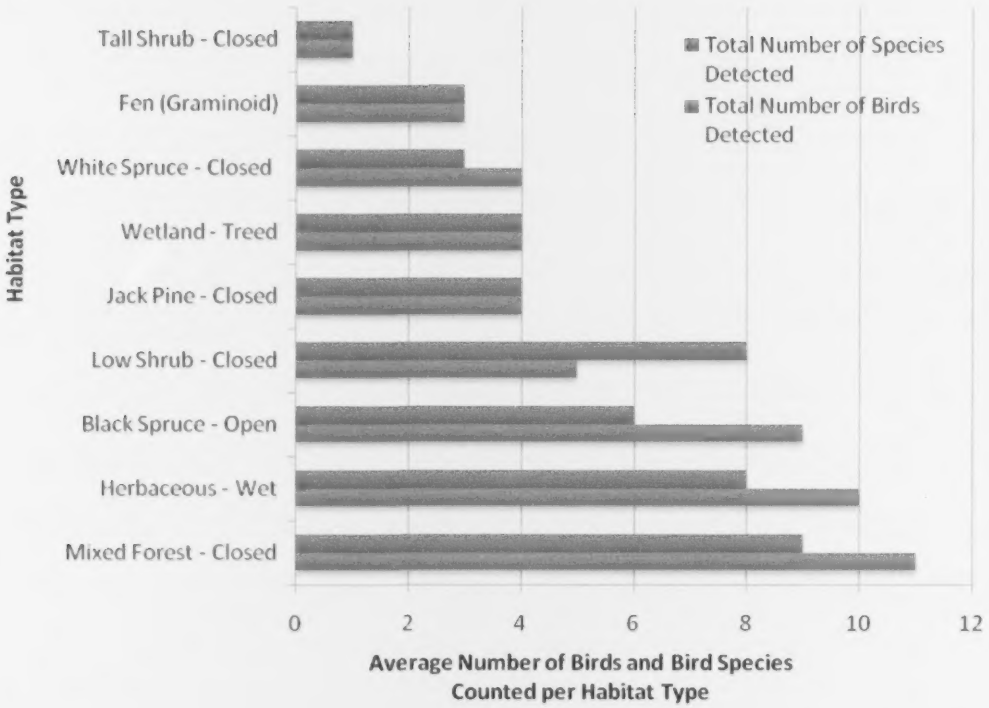


Figure 6. Average number of birds and bird species counted in the nine habitat types surveyed in Buffalo Lake, River and Trails with the marsh and fen (shrub) community types removed, June 2009.

Waterfowl Surveys

A waterfowl survey was conducted around the perimeter of the part of Buffalo Lake that was not part of WBNP, Yates River, Whitesand River, and ponds in northeast portion of study area.

A total of 105 waterfowl observations were documented representing 12 different species. The six most common waterfowl species were mallard, bufflehead, lesser scaup, Canada goose, northern shoveler, and American widgeon (Figures 6-7).

Figures 7 and 8 show the locations of all waterfowl observations. These were split into two maps for clarity in labelling according to species and number. A list of all waterfowl observed and expected to occur can be seen in Appendix D.

The most common waterfowl observed included mallard, bufflehead, lesser scaup, Canada goose, and northern shoveler. Most of these species are common breeders within the Buffalo Lake, River and Trails PAS region. The Canada goose however, is not believed to be a common breeder in the area, as most observations were of flocks. These geese were believed to be non-breeders and still migrating.

Other notable species observed includes the sandhill crane. A total of 44 sandhill cranes were counted, representing a minimum of 20 territories, based on paired adults (Figures 6-8). Cranes are common nesters in the fens and occur across the BLCA.

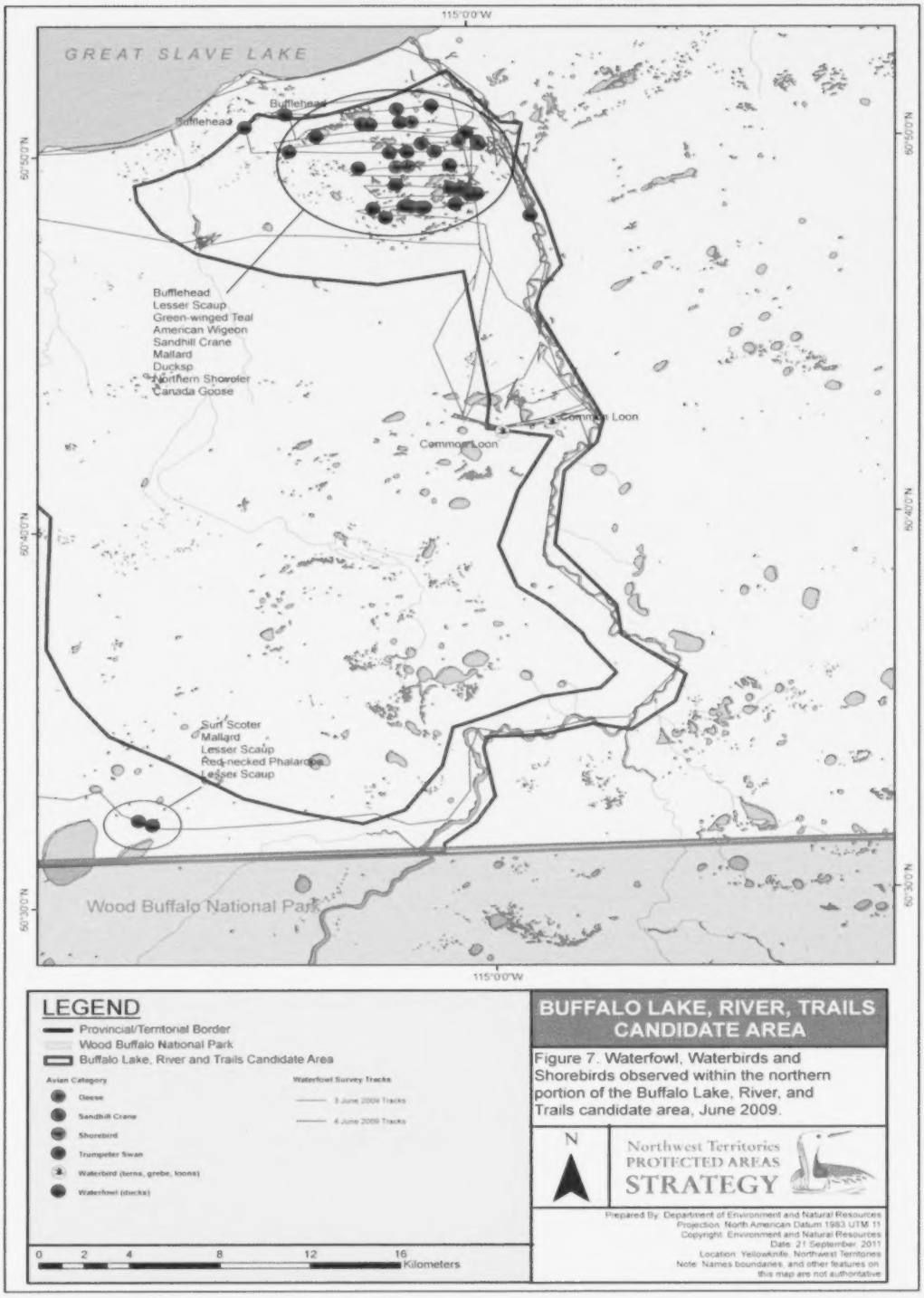


Figure 7. Waterfowl observed within the northern portion of Buffalo Lake, River, and Trails Candidate Area, June 2009.

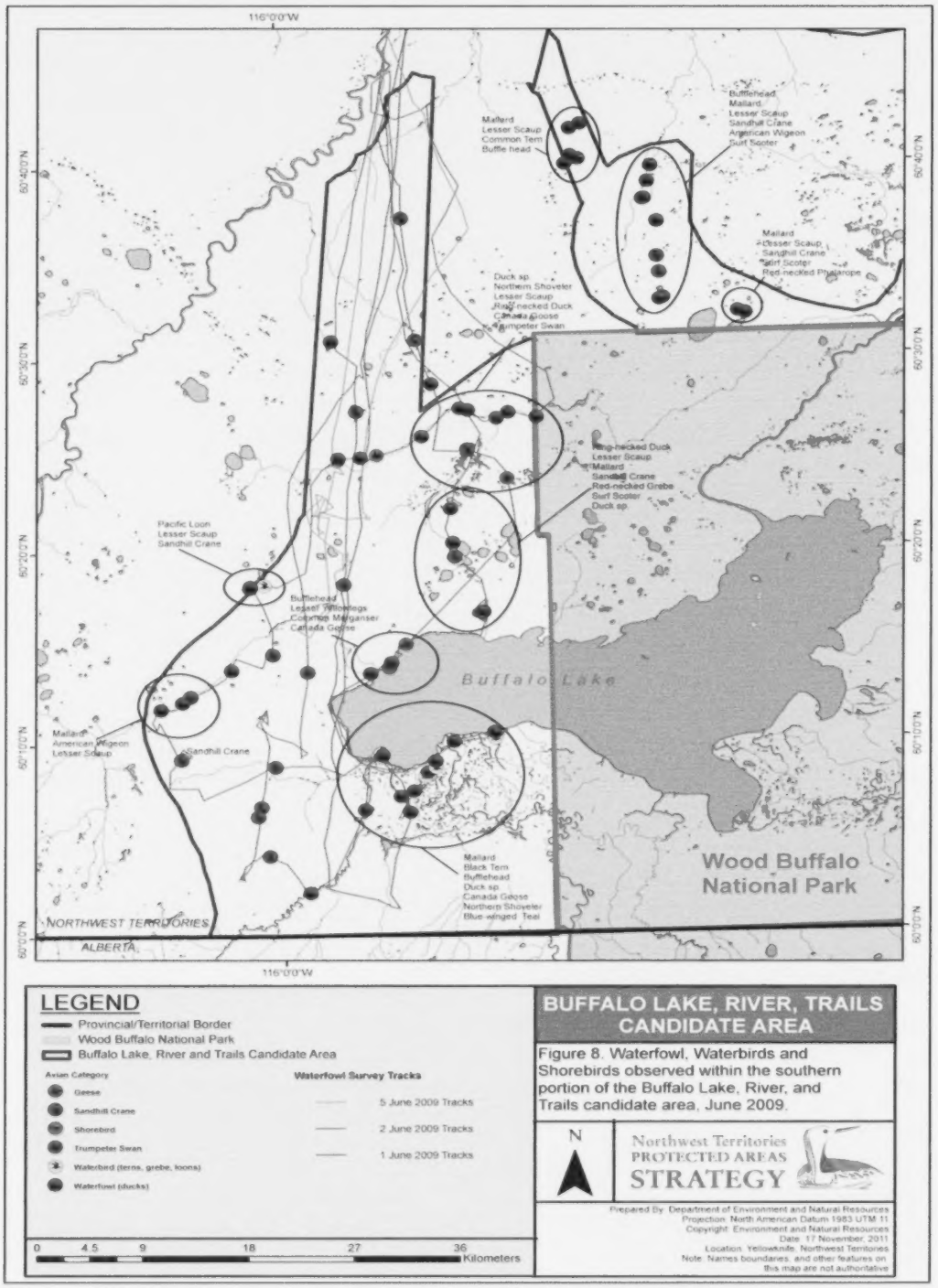
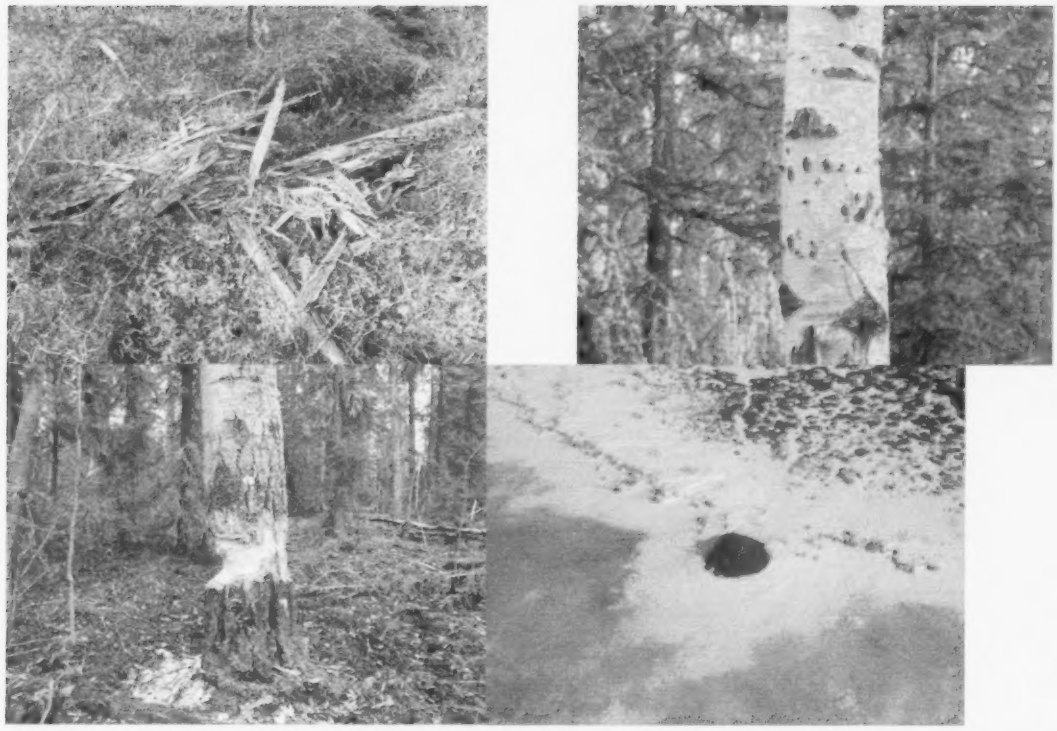


Figure 8. Waterfowl observed within the southern portion of Buffalo Lake, River, and Trails Candidate Area, June 2009.

MAMMALS

Mammals reported in the BLCA are listed in the Phase I Ecological Assessment for the area (Crosscurrent Associates Ltd. and Maskwa Environmental Services Ltd. 2007). As part of this Phase II Ecological Assessment, two mammal surveys were conducted in the area, one for moose between 30 November and 8 December, 2009 and another for muskrats between 31 March and 2 April, 2010. Additionally, all incidental wildlife observations were noted during all field work in BLCA. These observations are described in more detail in the moose survey section and in the section on incidental observations for all other species. General information was recorded in a field notebook and on specific datasheets where appropriate. Wildlife observations included individual visual observations, or animal observations inferred from tracks, trails, diggings, dens, browse, bark stripping and droppings or scat. See photographs of examples of wildlife signs seen in BLCA during the field work for this assessment in Photograph 1. Additional information was collected on habitat association and habitat use by the animal.



Photograph 1. Examples of wildlife signs observed within field surveys in Buffalo Lake, River and Trails Candidate Area. The top two pictures are signs of black bears; the first is the result of black bears breaking apart a log to find insects and the second shows the remnants of a black bear leaving claw marks in a tree. The two bottom pictures are signs of beavers; the first a tree in the process of being felled a beaver and the second a beaver (or muskrat) house at the edge of a lake.

A total of 431 different mammal observations were recorded during field studies between 3-5 June, 2009, 30 November to 8 December, 2009, and 31 March to 2 April, 2010, including actual sightings or signs. Evidence of ten different mammal species were documented between 3-5 June, 2009 as occurring in the study area, one additional mammal species, a single gray wolf, was observed during aerial moose surveys conducted in early December 2009 and an additional wolverine was observed during the muskrat survey in April 2010. A list of all wildlife species observed in BLCA during field work can be seen in Table 6.

Table 6. Mammal species observed in the Buffalo Lake, River, and Trails study area, June 2009, November/December 2009 and April 2010.

Family / *Scientific Name*	Common Name	Federal *Species at Risk Act* list	NWT General Status Rank[1]
LEPORIDAE			
Lepus americanus	Snowshoe hare	Not Assessed	Secure
Microtus pennsylvanicus	Meadow vole	Not Assessed	Secure
SCIRURIDAE			
Tamiasciurus hudsonicus	Red squirrel	Not Assessed	Secure
CASTORIDAE			
Castor canadensis	American beaver	Not Assessed	Secure
ERETHIZONTIDATE			
Erethizon dorsatum	North American porcupine	Not Assessed	Secure
CRICETIDAE			
Ondatra zibethicus	Common muskrat	Not Assessed	Secure
URSIDAE			
Ursus americanus	Black bear	Not At Risk	Secure
CANIDAE			
Canis lupus occidentalis	Boreal grey wolf	Not At Risk	Secure
CERVIDAE			
Rangifer tarandus caribou	Boreal woodland caribou	Threatened	Sensitive
Alces americanus	Moose	Not Assessed	Secure
MUSTELIDAE			
Lontra canadensis	North American river otter	Not Assessed	Secure
Gulo gulo	Wolverine	Special Concern	Sensitive

[1]ENR General Status Ranking 2011.

Moose

Methodology

In November to December 2009, ENR conducted an aerial moose census of a larger area between the Hay River, Buffalo River, and the NWT-AB border, but encompassing the entire BLCA. Below is a summary of the methodology employed

during this survey and more information is expected to be published later (Cluff pers. comm.).

The need for consistent moose survey techniques among regions led to a workshop on moose population assessments in Yellowknife in May 2003. The result of that workshop established the geospatial survey method as the standard for the NWT. This spatial technique is an extension of the 'Gasaway' method developed earlier in Alaska but with some important modifications on grid pattern and block size.

A map of the survey area for moose was developed in consultation with elders, hunters, and wildlife officers. The final area equals 5,707 km^2. Once the boundaries of the survey was finalized, a rectangular grid based on 2° latitude and 5° longitude (approx. 16 km^2) was overlaid on the survey area. Grid cells were then stratified as either high or low moose density. Stratification was based on sighting records of moose, harvest statistics, remotely sensed habitat assessment, community consultation, and expert opinion. Essentially, grid cells were ranked based on the yes/no assessment by biologists and hunters on whether a moose would likely occupy that area. Positive responses are assigned a high density and negative responses are ranked as low density. Once stratified, approximately 60 sample blocks were selected. Selection of grid cells was determined randomly for the first 90%, after which the remaining grid cells were selected non-randomly to fill in areas that were not covered or lightly sampled from the random selection.

A fixed-wing aircraft flew the survey in November/December 2009 with two observers on either side of the plane to sight moose. Navigation was facilitated by GPS to display grid cell corners and display a GPS tracking log as they are flown. This helped ensure complete visual coverage of the selected grid cells for moose in association with

the type of habitat encountered. All locations of animal sightings were recorded. Sex and age class of moose were recorded to estimate bull:cow and calf:cow ratios.

Results

The EOSD Land Cover Classification identified 18 vegetation community types (Table 3). Moose or moose sign were observed in 11 of the 18 community types. Broadleaf, mixed wood open and sparse, herbaceous, bryoids, and exposed land community types were not assessed due to time constraints and/or site accessibility. Moose sign was evident in all upland community types that were assessed.

During the November/December 2009 ENR moose survey, an average density of 5 moose/100 km^2 with an approximate ratio of 53 calves per 100 cows (SE 17) and 123 bulls per 100 cows (SE 40) was estimated. In the entire area of 5,707 km^2, the population estimate was 286 moose, but given the variance observed, the range was between 204-368 moose (using an 80% confidence interval). No twin calves were observed during this survey (Cluff pers. comm).

During other fieldwork conducted for the Phase II Ecological Assessment, incidental moose observations were also made. A total of 16 moose were seen during the vegetation, breeding bird, and waterfowl fieldwork in June 2009, made up of bulls, cows, and yearlings. Calves may have accompanied some of these adults but were likely concealed by vegetation and, consequently, not observed. Moose sign was also documented on 11 different sites. Two additional moose observations were made during the muskrat survey.

All sightings of moose made during field work for this Phase II Ecological Assessment, plus any sightings of moose during the annual BCA surveys conducted by ENR between 2003 and 2010, are included in Figure 9. Moose are scattered throughout

the study area year round with relatively high densities occurring in the Buffalo Lake, Whitesand and Yates Rivers. These observations correlate with moose observations documented in the Phase II Cultural Assessment (Green Consulting 2008).

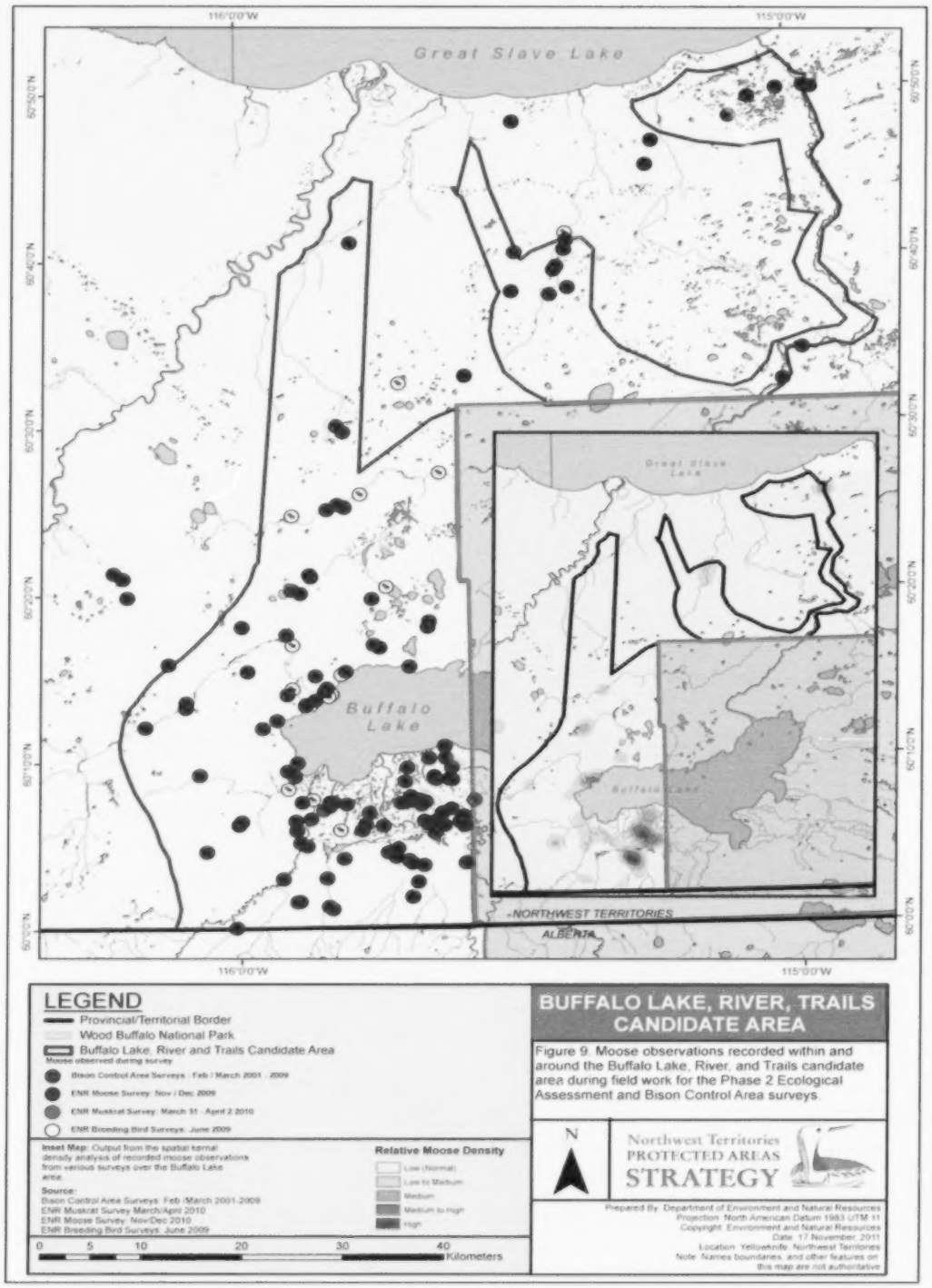

116°0'0"W
115°0'0"W
Great Slave Lake
Buffalo Lake
NORTHWEST TERRITORIES
ALBERTA
LEGEND
Provincial/Territorial Border
Wood Buffalo National Park
Buffalo Lake, River and Trails Candidate Area
Moose observed during survey
Bison Control Area Surveys : Feb / March 2001 - 2009
ENR Moose Survey: Nov / Dec 2009
ENR Muskrat Survey: March 31 - April 2 2010
ENR Breeding Bird Surveys: June 2009
Inset Map: Output from the spatial kernal density analysis of recorded moose observations from various surveys over the Buffalo Lake area
Source:
Bison Control Area Surveys: Feb /March 2001-2009
ENR Muskrat Survey March/April 2010
ENR Moose Survey: Nov/Dec 2010
ENR Breeding Bird Surveys: June 2009
Relative Moose Density
Low (Normal)
Low to Medium
Medium
Medium to High
High
0 5 10 20 30 40
Kilometers
BUFFALO LAKE, RIVER, TRAILS CANDIDATE AREA
Figure 9. Moose observations recorded within and around the Buffalo Lake, River, and Trails candidate area during field work for the Phase 2 Ecological Assessment and Bison Control Area surveys.
N
Northwest Territories
PROTECTED AREAS
STRATEGY
Prepared By: Department of Environment and Natural Resources
Projection: North American Datum 1983 UTM 11
Copyright: Environment and Natural Resources
Date: 17 November, 2011
Location: Yellowknife, Northwest Territories
Note: Names boundaries, and other features on this map are not authoritative

Figure 9. Moose observations recorded within and around the Buffalo Lake, River, and Trails Candidate Area during field work for the Phase II Ecological Assessment and BCA surveys.

Muskrat

Methodology

The primary objective of this study was to understand relative distribution of winter muskrat habitat, and relative abundance over time of muskrats in the BLTR. Using traditional knowledge (TK) from the KFN and other harvesters in the area to stratify the area, there was a focus on the area to the south of Buffalo Lake, namely where the Whitesand and Yates Rivers flow into Buffalo Lake. However, the entire candidate area was coarsely flown to see if any other pockets of winter muskrat habitat existed.

The survey was to count muskrat push-ups within the candidate area. Push-ups are structures created by muskrats over the middle of the ice to provide a breathing refuge and protection from predators. They are created by pushing up dirt and debris through a breathing hole and creating a dome shaped structure above the hole. Muskrats also make houses and feeding huts, but these can generally be distinguished from push-ups as they are larger structures. Muskrat push-ups are a good indication of relative distribution and abundance of muskrats within the candidate area. The number of push-ups observed also generally correlated with the amount of muskrat houses, which are usually harder to observe by air as they are closer to the edges of the waterbodies and can get blocked from view by shrubs and trees (Poole 2010 pers. comm., Westworth Associates Environmental Ltd. 1999).

The timing of the survey was critical. Muskrat push-ups can only be viewed by air once most of the snow has melted from the ice cover, prior to break-up. It was expected that the ideal time for survey in this area was mid-April. However, in 2010, the snow melt was early and the survey needed to be conducted much earlier. The survey dates ran from 31 March – 2 April, 2010. During the survey, the weather was mostly clear, but

sometimes with sporadic cloud and some ice fog that delayed flying. The temperature ranged from -5°C to +5°C.

A Found Bush Hawk plane was used to fly the survey, with generally two observers sitting on either side of the plane. The observers identified and informed the navigator at the front of the aircraft of all muskrat push-ups on ice observed within 500 m of either side of the plane. The plane was flown at a constant altitude of 350 m and a speed ranging between 125 km/hr. and 175 km/hr., depending on wind.

Results

The tracks flown each day during the survey can be seen in Figure 10. Extra attention was paid to the area south of Buffalo Lake, where the Whitesand and Yates Rivers flow into Buffalo Lake. This area had been previously identified by the KFN as an important muskrat harvesting area. On the first day of flying (31 March, 2010), the entire area south of Buffalo Lake was flown at a coarser scale; approximately 2 km transects to determine where the muskrat push-ups were. On the second day, 1 April, 2010, very tight transect lines (1 km) were flown to get good coverage of the area where muskrat push-ups were found on 31 March, 2010. On 31 March, 2010, only one observer was available, however on 1 and 2 April, 2010, two observers were available to ensure that muskrat push-ups on both sides of the planes were being noted. It was estimated that muskrat push-ups on ice that could be spotted up to 500 m from either side of the plane were being noted. As can be seen from Photograph 2, muskrat push-ups were easy to spot on the lakes at this time.

All muskrat push-ups observed during the three days of surveying can be seen in Figure 10, with an insert of the area with the highest muskrat push-up density flown on 1 April, 2010. A number of areas emerged as good winter muskrat habitat, including a

medium sized lake south of Buffalo Lake that is unnamed on the topographic maps for the region, but was called 'Muskrat Lake' by survey staff (Photograph 2).

Photograph 2. Photograph of the muskrat push-ups in an unnamed lake, referred to as "Muskrat Lake" in the text, with a particularly high density of muskrat push-ups, south of Buffalo Lake.

On 1 April, an intensive survey was conducted in an area south of Buffalo Lake, where the Whitesand and Yates Rivers flow into Buffalo Lake. The survey was flown with 1 km transects. Assuming that observers were able to visually determine muskrat houses up to 500 m from the plane, the survey flights should have full coverage of this smaller study area, but muskrat push-ups should not have been double counted. On this day, 436 muskrat push-ups were observed. The smaller study area is approximately 390 km^2, so the density of muskrat push-ups is estimated to be 1.1 push-ups per km^2 in this smaller study area (Figure 11). A kernel density analysis using a search radius of 3.5 km and the BLRT boundary as the extent, identified 'Muskrat Lake' as having the highest

relative density of muskrat push-ups (Figure 11); 94 (or 22%) were observed on 'Muskrat Lake' with an additional 15 observed in a river, which was presumed to flow into 'Muskrat Lake', bringing the total to 105 muskrat push-ups (or 25%). Muskrat push-ups were nearly non-existent in areas outside of this smaller study area when coarsely surveyed, except for a few observed along a river flowing into Buffalo Lake to the northwest (Figure 10).

Habitat where the muskrat push-ups were observed was also noted. The majority of the muskrat push-ups were observed over lakes, but some were also found on streams and rivers. The area is criss-crossed by streams and lakes as the Whitesand and Yates Rivers flow into Buffalo Lake. There are some deciduous and spruce forest sands, and some shrubby areas, however some areas appear to be wetlands in the spring and summer.

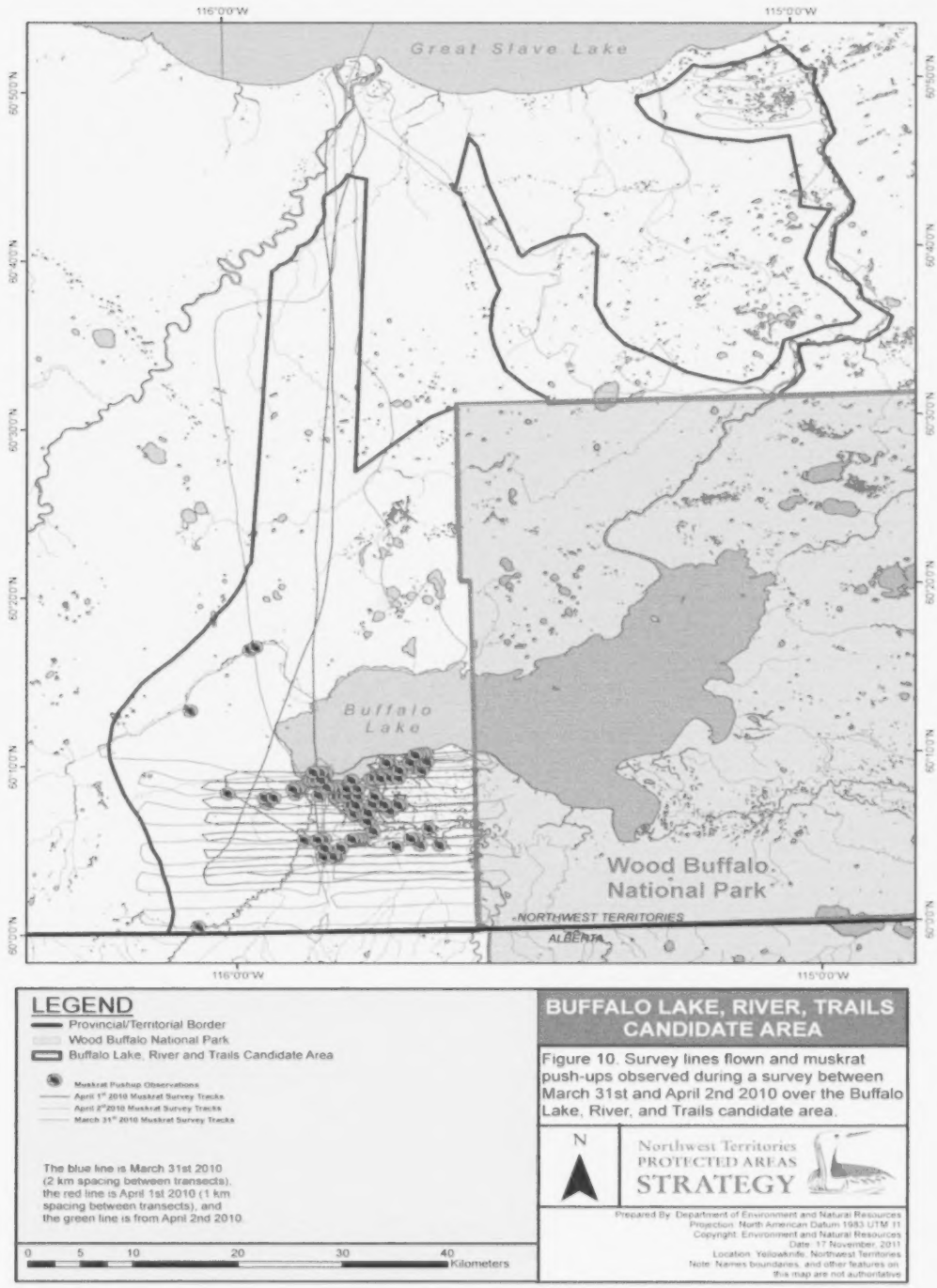

116°0'0"W
115°0'0"W
Great Slave Lake
60°50'0"N
60°40'0"N
60°30'0"N
60°20'0"N
60°10'0"N
60°0'0"N
Buffalo Lake
Wood Buffalo National Park
NORTHWEST TERRITORIES
ALBERTA
LEGEND
Provincial/Territorial Border
Wood Buffalo National Park
Buffalo Lake, River and Trails Candidate Area
Muskrat Pushup Observations
April 1st 2010 Muskrat Survey Tracks
April 2nd 2010 Muskrat Survey Tracks
March 31st 2010 Muskrat Survey Tracks
The blue line is March 31st 2010 (2 km spacing between transects), the red line is April 1st 2010 (1 km spacing between transects), and the green line is from April 2nd 2010.
0 5 10 20 30 40
Kilometers
BUFFALO LAKE, RIVER, TRAILS CANDIDATE AREA
Figure 10. Survey lines flown and muskrat push-ups observed during a survey between March 31st and April 2nd 2010 over the Buffalo Lake, River, and Trails candidate area.
N
Northwest Territories PROTECTED AREAS STRATEGY
Prepared By: Department of Environment and Natural Resources
Projection: North American Datum 1983 UTM 11
Copyright: Environment and Natural Resources
Date: 17 November, 2011
Location: Yellowknife, Northwest Territories
Note: Names boundaries, and other features on this map are not authoritative

Figure 10. Survey lines flown during a muskrat survey between 31 March and 2 April, 2010 over the Buffalo Lake, River and Trails Candidate Area.

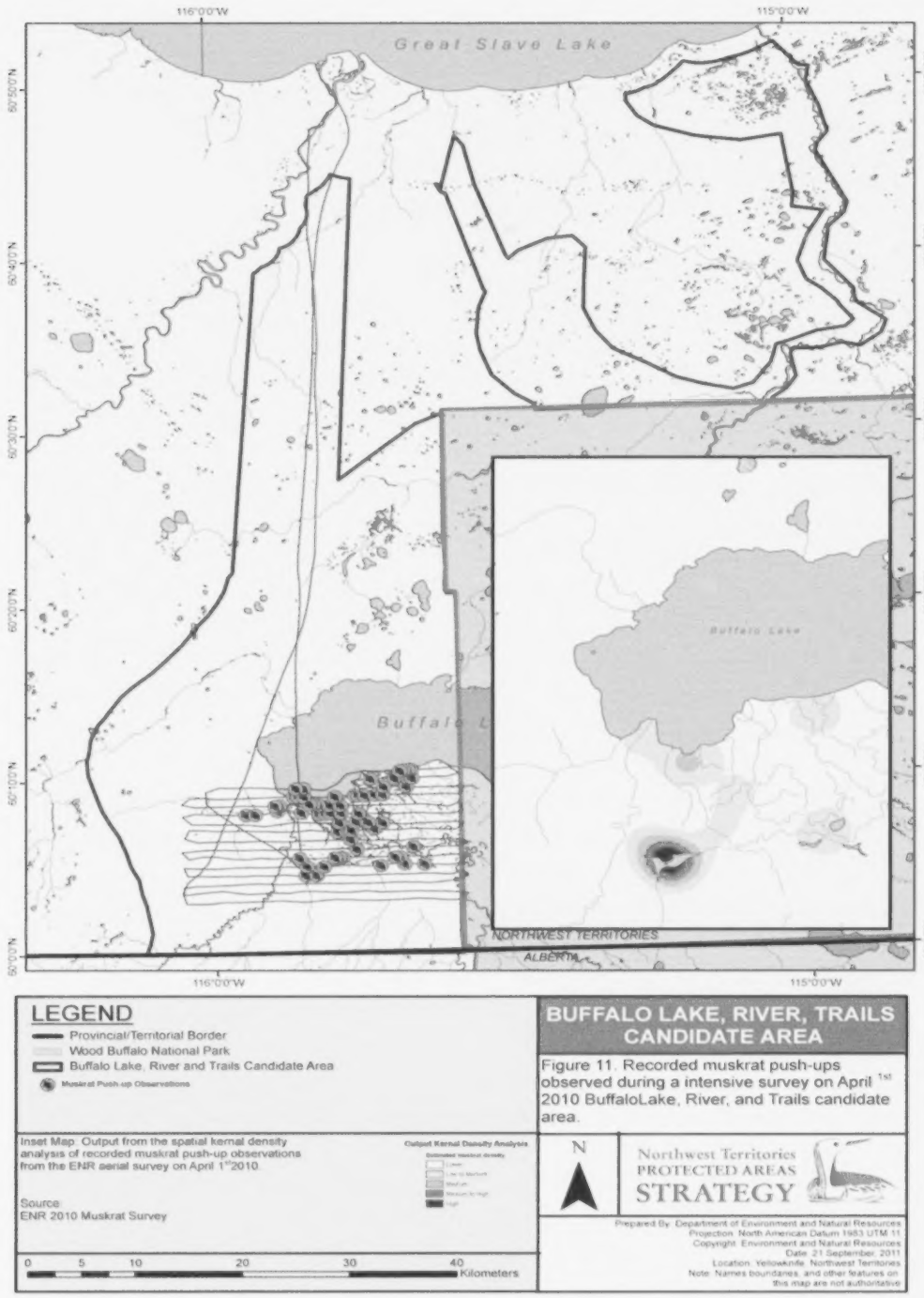

116°0'0"W
115°0'0"W
Great Slave Lake
60°50'0"N
60°40'0"N
60°30'0"N
60°20'0"N
60°10'0"N
60°0'0"N
Buffalo Lake
NORTHWEST TERRITORIES
ALBERTA
LEGEND
Provincial/Territorial Border
Wood Buffalo National Park
Buffalo Lake, River and Trails Candidate Area
Muskrat Push-up Observations
BUFFALO LAKE, RIVER, TRAILS CANDIDATE AREA
Figure 11. Recorded muskrat push-ups observed during a intensive survey on April 1st 2010 BuffaloLake, River, and Trails candidate area.
Inset Map: Output from the spatial kernal density analysis of recorded muskrat push-up observations from the ENR aerial survey on April 1st 2010.
Source:
ENR 2010 Muskrat Survey
Output Kernal Density Analysis
0 5 10 20 30 40
Kilometers
N
Northwest Territories
PROTECTED AREAS
STRATEGY
Prepared By: Department of Environment and Natural Resources
Projection: North American Datum 1983 UTM 11
Copyright: Environment and Natural Resources
Date: 21 September, 2011
Location: Yellowknife, Northwest Territories
Note: Names boundaries, and other features on this map are not authoritative

Figure 11. Muskrat push-ups observed during the more intensive aerial survey of the Yates and Whitesand Rivers on 1 April, 2010.

OTHER WILDLIFE OBSERVATIONS

During all field work conducted for the Phase II Ecological Assessment for BLCA, incidental wildlife observations were noted.

Amphibians

Two species of amphibians are known to occur in the study area: boreal chorus frog (*Pseudacris maculata*) and wood frog (*Rana sylvatica*). Northern leopard frogs (*Rana pipiens*) are found along the Taltson River, east of BLCA, but to date have not been observed in the study area. Two separate observations of boreal chorus frogs calling were documented within the study area during the June 2009 field program. Each observation consisted of numerous individuals calling at a wetland. Baseline environmental research conducted by EBA Engineering Consultants Ltd. (EBA) for the Pine Point area, including an auditory survey in May 2006, heard frequent calling by wood and boreal chorus frogs as well (Tamerlane Developers Assessment Report for the Pine Point Pilot Project, April 2007).

Birds

The most common raptor observed in the study area was the bald eagle, which were common throughout the study area (Figure 12). A total of 47 eagles were documented over 3.5 days, occurring predominantly along water courses, particularly rivers. Bald eagles were observed in high densities along the lower Buffalo River at a ratio of about 50% adults and 50% immature. Several nest sites were also observed.

Other raptors including northern harrier, great horned owl, osprey, boreal owl, short-eared owl, northern goshawk, and common nighthawk were observed during field work (Figure 12). Eight northern harriers, mostly males, were observed hunting in June 2009. This species is believed to be breeding in the study area. Eight great horned owls

were documented, in June and December 2009, including one observation of a nesting pair consisting of two adults and three chicks. One osprey was observed carrying a fish. One nesting cavity, presumed to be have been used by a boreal owl, was documented in June 2009. Two short-eared owls were observed hunting in June 2009. These two owls are presumed to represent two breeding territories based on the time of year. Three northern goshawks were recorded during December moose surveys. One common nighthawk was observed hunting in June 2009.

Other raptors may exist in the BLCA. During environmental baseline field work for the Tamerlane Pine Point Pilot Project in 2005 and 2006, a peregrine falcon was noted feeding on a snow goose it had just killed. In addition, during their owl surveys one great grey owl, one long-eared owl, in addition to the five great horned owl and seven boreal owls, were observed.

A few other land birds were observed during the Phase II Ecological Assessment field work (Figure 12). These included aerial sightings of three red-winged blackbirds, a belted kingfisher, a ptarmigan, a common raven, and a pileated woodpecker. During the December 2009 moose survey a total of 103 sharp-tailed grouse were counted. Sharp-tailed grouse were commonly seen during the aerial moose survey, occurring on the margins of shrub fens and in mixed forest plant community type.

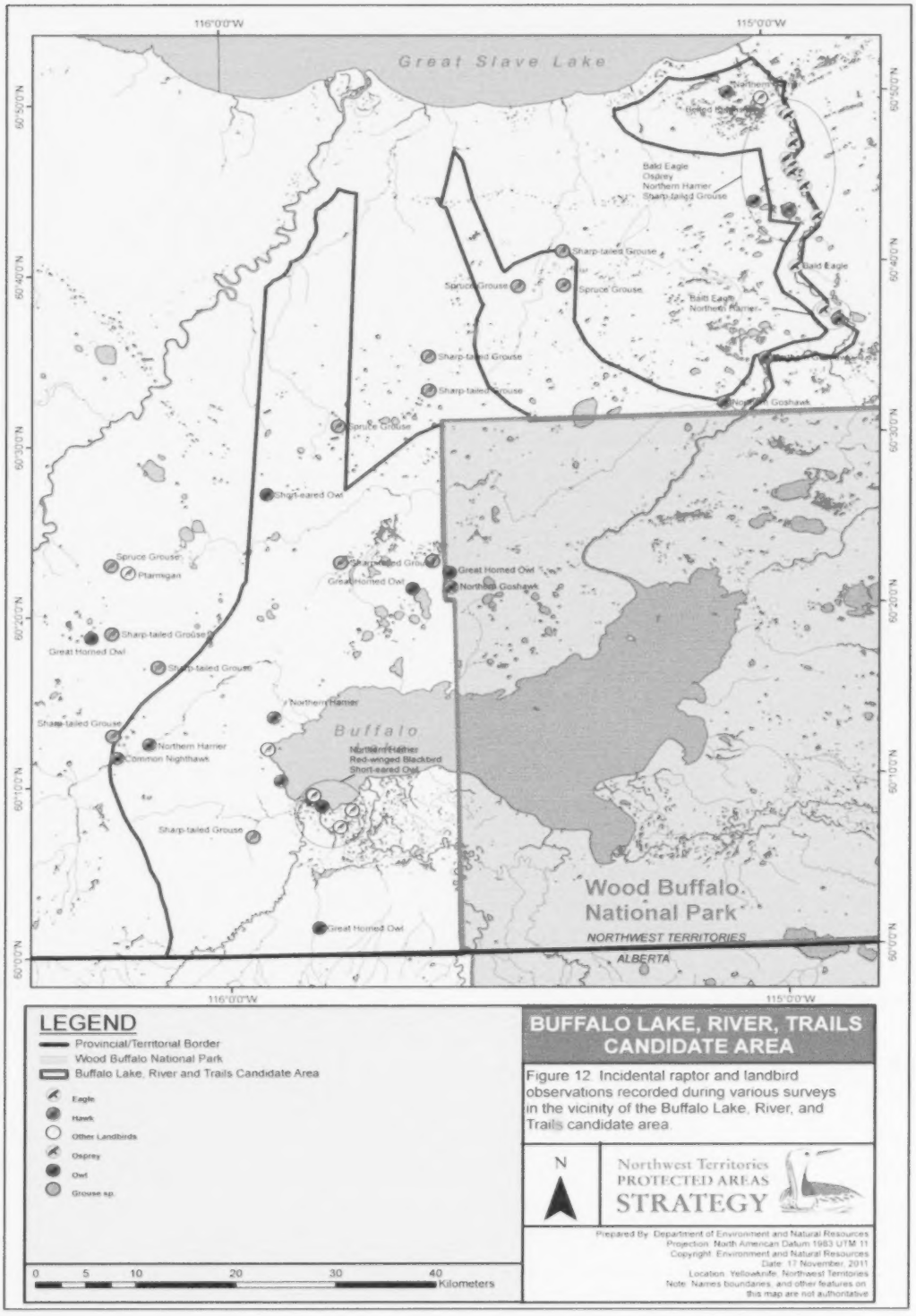


Figure 12. Incidental raptor and land bird observations recorded during various surveys in the vicinity of the Buffalo Lake, River, and Trails Candidate Area.

Mammals

The most common incidental mammal observations, in order of frequency but not including moose, which are described above, were beaver, boreal caribou, and black bear (Figure 13). Further details on the boreal caribou observed in the BLCA are detailed in a separate section below.

Although only one adult beaver was observed swimming in the Yates River, beaver sign is common across the study area. A total of 20 different observations were recorded during 2009 and include lodges, dams, and felled trees. Many other signs of beaver were not recorded as field workers were focused on other aspects of documenting wildlife. Beaver lodges were recorded during the first day of the muskrat survey on 31 March, 2010 (Figure 13).

Evidence of black bears was common across the study area. Six black bears were observed (Figure 13); an additional six observations were of sign, which included feeding, tracks, scat, and claw marks on trees.

Boreal Woodland Caribou

Boreal caribou occur throughout much of the BLCA in low densities (Figure 14). Density estimates for the southeast portion of the Dehcho and South Slave are approximately three individuals per 100 km^2 (ENR 2009a), and presumed to be applicable for the BLCA. Some of, if not all, the boreal caribou occurring in the BLCA may move freely across the NWT-AB border (Alberta Caribou Committee 2009).

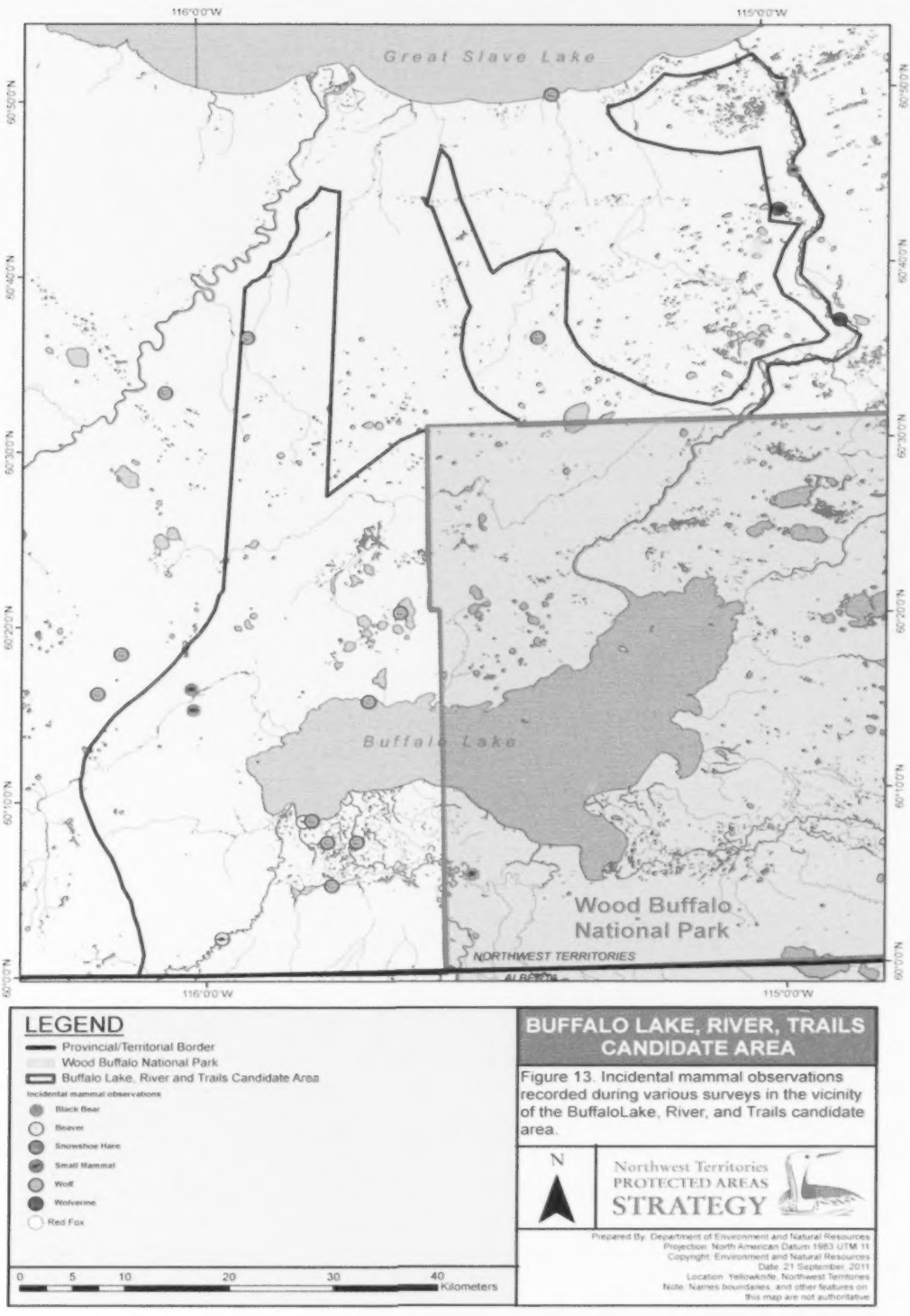


Figure 13. Incidental mammal observations recorded during various surveys in the vicinity of the Buffalo Lake, River, and Trails Candidate Area.

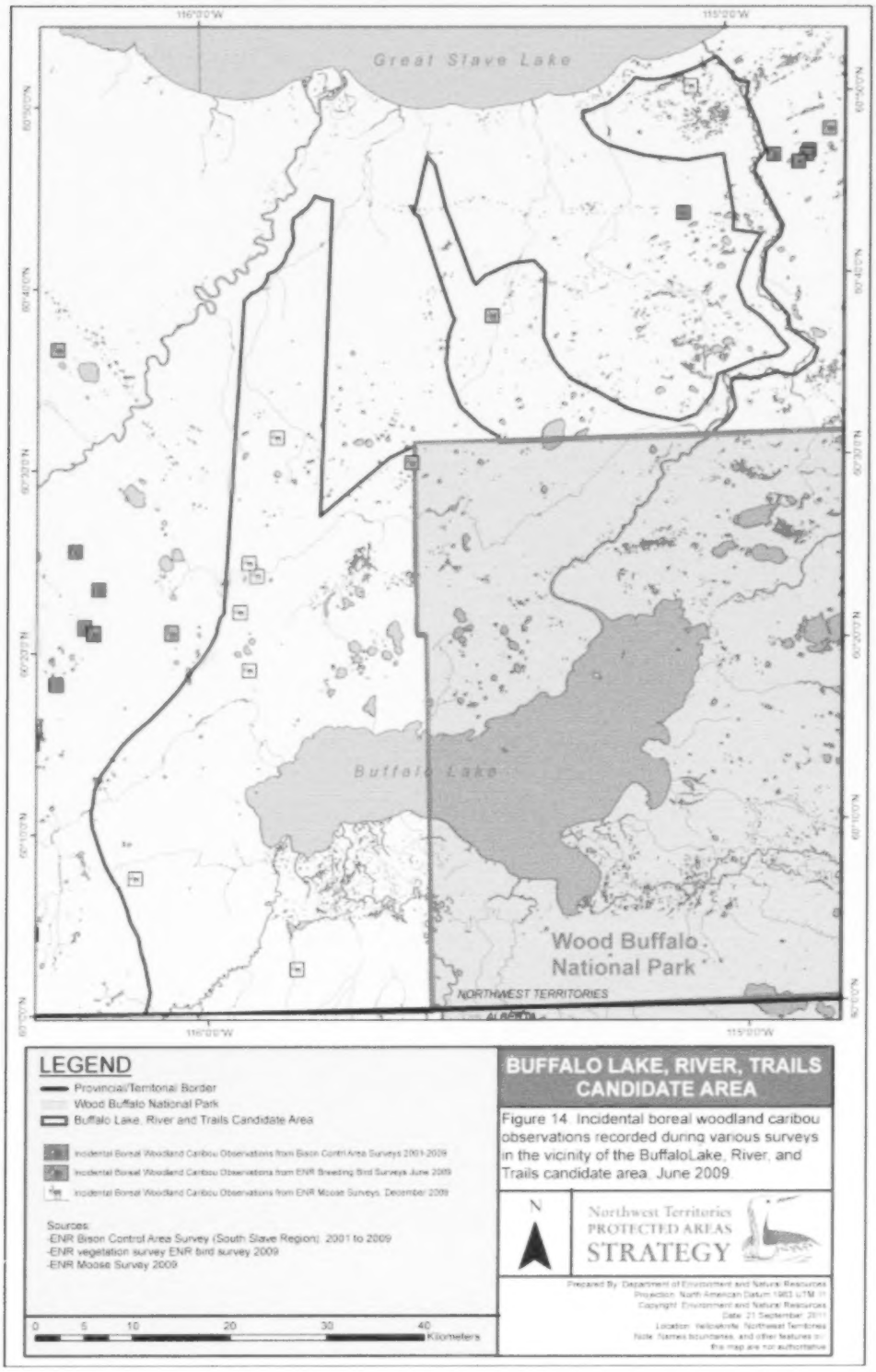

Great Slave Lake
Buffalo Lake
Wood Buffalo
National Park
NORTHWEST TERRITORIES
ALBERTA
116°00'W
115°00'W
LEGEND
Provincial/Territorial Border
Wood Buffalo National Park
Buffalo Lake, River and Trails Candidate Area
Incidental Boreal Woodland Caribou Observations from Bison Contrl Area Surveys 2001-2009
Incidental Boreal Woodland Caribou Observations from ENR Breeding Bird Surveys June 2009
Incidental Boreal Woodland Caribou Observations from ENR Moose Surveys, December 2009
Sources:
-ENR Bison Control Area Survey (South Slave Region), 2001 to 2009
-ENR vegetation survey ENR bird survey 2009
-ENR Moose Survey 2009
0 5 10 20 30 40
Kilometers
BUFFALO LAKE, RIVER, TRAILS CANDIDATE AREA
Figure 14. Incidental boreal woodland caribou observations recorded during various surveys in the vicinity of the BuffaloLake, River, and Trails candidate area. June 2009.
N
Northwest Territories
PROTECTED AREAS
STRATEGY

Figure 14. Incidental boreal woodland caribou observations recorded during various surveys in the vicinity of the Buffalo Lake, River, and Trails Candidate Area.

To the west of BLCA, in the Slave River Lowlands, a research and monitoring program is underway to look at various population demographics and habitat selection using caribou boreal collar data (Kelly and Cox 2011). Boreal caribou prefer mature or old growth coniferous forests. Preferred habitat also includes areas with lichen and wetland habitats such as treed fens and bogs; treed fen and bog habitats receive the highest boreal caribou use, and they consistently select these peatland habitats over other habitat types available in their home range, using upland habitats the least (Anderson 1999, Nagy 2011, Species at Risk Committee 2012).

Within the BLCA, there is currently limited good boreal caribou habitat because nearly the entire area had a major fire in the 1940s and the early 1980s which would minimize the preferred habitat available for boreal caribou in the area (Carlson et al. 2008, Crosscurrent Associates Ltd. and Maskwa Environmental Services Ltd. 2007). Boreal caribou can occur where appropriate wetland habitats exist within the BLCA and this was supported by incidental boreal caribou locations which were recorded in the BLCA during all field surveys (Figure 14).

A total of 93 boreal caribou were observed and an additional 23 observations of caribou sign were recorded during June and December 2009. The majority of these observations were associated with shrub fens, graminoid fens or frozen lake surfaces. During the aerial moose survey in the late fall/early winter of 2009, boreal caribou were observed occupying peatlands (including sedge, shrubby and treed fens/bogs) (Moore pers. comm 2011). In addition, ENR's database for animals observed during the BCA survey between 2003-2010 reveal that caribou are commonly recorded within the study area; observations are typically associated with fen habitat (Figure 14).

In June 2009 observations included caribou cows with new born calves, confirming that they are calving in the BLCA. Boreal caribou disperse to calve individually in forests, peatlands, islands, lakeshores, and tundra thereby reducing predation. In addition, female boreal caribou are found to have low fidelity to the sites where they previously calved (Species at Risk Committee 2012).

Local knowledge indicates boreal caribou are observed in small groups ranging from two to 40 individuals during the winter, and are believed to move south into the Caribou Mountains (northern AB) for spring calving and summer (Green Consulting 2008). Known boreal caribou harvesting locations include near the west end of Buffalo Lake, between Buffalo Lake and Snake River, and along rivers and streams in the BLCA (Green Consulting 2008). Based on consultations with elders, boreal caribou are not harvested as often today, but were once an essential resource for the KFN people (Green Consulting 2008). Although not harvested to the same historical extent, a few KFN members continue to actively hunt boreal caribou and most people will harvest them opportunistically (Green Consulting 2008).

It is of note that a large wetland complex outside and immediately west of the BLCA, which coincides with an area that has not burned in the past 50 years, may provide better boreal caribou habitat (Moore pers. comm.). In this area there is a relatively large concentration of boreal caribou harvest sites and sightings during the ENR moose survey (Figure 14).

DISCUSSION AND CONCLUSIONS

The results of this Phase II Ecological Assessment provided some extra data where the Phase I Ecological Assessment identified some deficiencies (Crosscurrent Associates Ltd. and Maskwa Environmental Services Ltd. 2007). The results also supported ecological information presented and discussed in the Phase II Cultural Assessment for the K'átł'odeeche First Nation (Green Consulting 2008). The information in this assessment, along with the other assessment commissioned, should help the Buffalo Lake, River, and Trails Working Group make decisions on a final recommended boundary and provide information for a recommended management plan for the area.

The purpose of the field work conducted in June 2009 was to look at vegetation, breeding birds, and waterfowl that use the BLCA. With the timing of the survey, it was hoped to catch the peak of bird migration through the Buffalo Lake area and that there would be enough emergent vegetation to identify plants to species. However, the spring of 2009 was uncharacteristically cool, so the migratory birds and vegetation were likely delayed.

It is possible that plant families represented may not be the most common or dominant plant families occurring within the study area. Instead they are representative of the species documented over the short-field event (three days) and those that were more readily observable. It was still early in the growing season and many plants had not yet developed (or flushed out) by the time the field surveys occurred. Empirical evidence from adjacent study areas suggest that Poaceae (grass family) is under represented in this list; this is likely due to the fact that they had not had a chance to grow (develop) by the beginning of June.

For the purpose of this assessment, the Phase II information should still give a good idea of the birds and vegetation present in the study area. Further multi-year studies would be helpful to refine the types of breeding birds that use the study area and how migrating birds move through the study area, and to describe all plant species present in the study area.

Although no rare plants were observed, this could have been impacted by the delayed spring or the amount of time spent in the study area. To truly get an idea of what rare plants are present in the study area, a more comprehensive survey would be required, with a focus on ground surveys.

The breeding bird surveys show that in the BLCA, the marsh communities have the highest number of birds (Figure 5). This is expected as this plant community chronologically advances earlier in the season than other plant communities and faster than other upland sites. This may have been even more emphasised by the late spring weather in 2009.

Waterfowl are also prominent in the study area. It is expected that Buffalo Lake, as well as other larger water bodies in the BLCA, are important staging habitat for birds during their migration. Some relatively large patches of habitat have been identified within BLCA during this assessment, including important habitat for waterfowl (dissected marshes), wetland birds (sedges/cattails), and shorebird habitat (sedge meadows).

Work conducted in collaboration with this Phase II Ecological Assessment on moose distribution and abundance for an area encompassing the BLCA supports that this region has relatively high density of moose at five moose per 100 km^2. This density is slightly higher than recent moose population surveys in the Dehcho Region where in 2003/2004 there were 4.4 moose per 100 km^2 in the Mackenzie Valley and 4.9 moose

per 100 km^2 in the Liard Valley. This density is also higher than what has been documented in the North Slave Region where in 2007 there were 3.8 moose per 100 km^2 in the Taiga Plains and 4.1 moose per 100 km^2 in the Taiga Shield ecozones. Moose observations made during this field work and other surveys conducted by ENR identify that the rich deltas south of Buffalo Lake where the Yates and Whitesand Rivers enter Buffalo Lake provide the best moose habitat within the BLCA. These alluvial-colluvial slopes have been previously identified by the Ecosystem Classification Group as having excellent wildlife habitat (Ecosystem Classification Group 2007).

The aerial survey for muskrat push-ups relates to relative muskrat abundance and can be repeated to monitor muskrat abundance over time for a particular area. This survey provides some baseline data on muskrat abundance for the area south of Buffalo Lake. It was noted by elders that muskrat used to be plentiful throughout the BLCA but that in the past fifteen years or so the population has been decreasing (Green Consulting 2008). Within the smaller study area south of Buffalo Lake, 436 muskrat push-ups were observed. The number of muskrat push-ups observed is similar to numbers observed during previous studies in the Peace-Athabasca delta. In 1999, muskrat push-ups observed in various basins in the delta ranged from 0-320, with a mean of 62 push-ups per basin (Westworth Associates Environmental Ltd. 1999). Although a much smaller area, on one lake within our study area, 'Muskrat Lake' was found to contain 94 muskrat push-ups (105 including the river that was flowing in/out).

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APPENDIX A. Plant species observed in the Buffalo Lake, River, and Trails Candidate Area.

Common Name	Scientific Name	Order	Family	NWT GSRank [1]
Siberian yarrow	*Achillea alpine*	Asterales	Asteraceae	Secure
Black-tip ragwort	*Senecio lugens*	Asterales	Asteraceae	Secure
Common dandelion	*Taraxacum officinale*	Asterales	Asteraceae	Alien
Bog yellowcress	*Rorippa palustris*	Capparales	Brassicaceae	Secure
Dwarf dogwood (Bunchberry)	*Cornus canadensis*	Cornales	Cornaceae	Secure
Red osier dogwood	*Cornus sericea*	Cornales	Cornaceae	Secure
Water sedge	*Carex aquatilis*	Cyperales	Cyperaceae	Secure
Hairlike sedge	*Carex capillaris*	Cyperales	Cyperaceae	Secure
Lesser panicled sedge	*Carex diandra*	Cyperales	Cyperaceae	Secure
Needle spike rush	*Eleocharis acicularis*	Cyperales	Cyperaceae	Secure
Soft-stem bulrush	*Eleocharis mamillata*	Cyperales	Cyperaceae	Undetermined
Blue-jointed reed grass	*Calamagrostis canadensis*	Cyperales	Poaceae	Secure
Slender wood reed grass	*Cinna latifolia*	Cyperales	Poaceae	Sensitive
Twinflower	*Linnaea borealis*	Dipsacales	Caprifoliaceae	Secure
Squashberry (High-bush cranberry)	*Vibaqrurnum edule*	Dipsacales	Caprifoliaceae	Secure
Dwarf scouring-rush	*Equisetum scirpoides*	Equisetales	Equisetaceae	Secure
Bog rosemary	*Andromeda polifolia*	Ericales	Ericaceae	Secure
Red bearberry	*Arctostaphylos rubra*	Ericales	Ericaceae	Secure
Common bearberry (Kinnikinnik)	*Arctostaphylos uva-ursi*	Ericales	Ericaceae	Secure
Leatherleaf	*Chamaedaphne calyculata*	Ericales	Ericaceae	Secure
Common Labrador tea	*Ledum groenlandicum*	Ericales	Ericaceae	Secure
Narrow-leaved Labrador tea	*Ledum palustre*	Ericales	Ericaceae	Secure
Small cranberry	*Vaccinium oxycoccos*	Ericales	Ericaceae	Secure
Alpine bilberry	*Vaccinium uliginosum*	Ericales	Ericaceae	Secure
Rock cranberry (Lingonberry)	*Vaccinium vitis-idaea*	Ericales	Ericaceae	Secure
One-sided wintergreen	*Orthilia secunda*	Ericales	Pyrolaceae	Secure

Common Name	Scientific Name	Order	Family	NWT GSRank [1]
Pink pyrola	*Pyrola asarifolia*	Ericales	Pyrolaceae	Secure
Arctic pyrola	*Pyrola grandiflora*	Ericales	Pyrolaceae	Secure
Lesser pyrola	*Pyrola minor*	Ericales	Pyrolaceae	Secure
Speckled alder	*Alnus incana*	Fagales	Betulaceae	Secure
Arctic dwarf birch	*Betula nana*	Fagales	Betulaceae	Secure
Water birch	*Betula occidentalis*	Fagales	Betulaceae	Secure
Paper birch	*Betula papyrifera*	Fagales	Betulaceae	Secure
Northern green rush	*Juncus alpinoarticulatus*	Juncales	Juncaceae	Secure
Scotch false asphodel	*Tofieldia pusilla*	Liliales	Liliaceae	Secure
Mountain death camas	*Zigadenus elegans*	Liliales	Liliaceae	Secure
Running clubmoss	*Lycopodium clavatum*	Lycopodales	Lycopodiaceae	Undetermined
Sweet gale	*Myrica gale*	Myricales	Myricaceae	Secure
Round-leaved sundew	*Drosera rotundifolia*	Nepenthales	Droseraceae	Secure
Calypso orchid	*Calypso bulbosa*	Orchidales	Orchidaceae	Secure
Common juniper (Ground juniper)	*Juniperus communis*	Pinales	Cupressaceae	Secure
Creeping juniper	*Juniperus horizontalis*	Pinales	Cupressaceae	Secure
Tamarack	*Larix laricina*	Pinales	Pinaceae	Secure
White spruce	*Picea glauca*	Pinales	Pinaceae	Secure
Black spruce	*Picea mariana*	Pinales	Pinaceae	Secure
Jack pine	*Pinus banksiana*	Pinales	Pinaceae	Secure
Pygmy-flower rock-jasmine	*Androsace septentrionalis*	Primulales	Primulaceae	Secure
Blue columbine	*Aquilegia brevistyla*	Ranunculales	Ranunculaceae	Secure
Buffalo-berry	*Shepherdia canadensis*	Rhamnales	Elaeagnaceae	Secure
Shrubby cinquefoil	*Dasiphora fruticosa*	Rosales	Rosaceae	Secure
Virginia strawberry	*Fragaria virginiana*	Rosales	Rosaceae	Secure
Prickly rose	*Rosa acicularis*	Rosales	Rosaceae	Secure
Woods rose	*Rosa woodsii*	Rosales	Rosaceae	Secure
Cloudberry	*Rubus chamaemorus*	Rosales	Rosaceae	Secure

Common Name	Scientific Name	Order	Family	NWT GSRank [1]
Bare-stem bishop's cap	*Mitella nuda*	Rosales	Saxifragaceae	Secure
Northern bedstraw	*Galium boreale*	Rubiales	Rubiaceae	Secure
Balsam poplar	*Populus balsamifera*	Salicales	Salicaceae	Secure
Trembling aspen	*Populus tremuloides*	Salicales	Salicaceae	Secure
Littletree willow	*Salix arbusculoides*	Salicales	Salicaceae	Secure
Hoary willow	*Salix candida*	Salicales	Salicaceae	Secure
Gray willow	*Salix glauca*	Salicales	Salicaceae	Secure
Shining willow	*Salix lucida*	Salicales	Salicaceae	Secure
Blueberry willow	*Salix myrtillifolia*	Salicales	Salicaceae	Secure
Diamond-leaved willow	*Salix planifolia*	Salicales	Salicaceae	Secure
Scouler willow	*Salix scouleriana*	Salicales	Salicaceae	Secure
Common butterwort	*Pinguicula vulgaris*	Scrophulariales	Lentibulariaceae	Secure
Labrador lousewort	*Pedicularis labradorica*	Scrophulariales	Scrophulariaceae	Secure
Broad-leaf cattail	*Typha latifolia*	Typhales	Typhaceae	Secure

[1]ENR General Status Ranking 2011.

None of the species listed were been assessed by COSEWIC.

APPENDIX B. Site Photographs.

Tall shrub

Photograph 3. Tall Shrub community. Site BL-10.

Photograph 4. Tall Shrub community, within a wet riparian zone. Site BL-17.

Photograph 5. Tall Shrub community from the air.

Low shrub

Photograph 6. Low shrub community. Site BL-2.

Photograph 7. Low shrub community. Site BL-15.

Photograph 8. Low shrub community. Site BL-18.

Photograph 9. Low shrub community from the air.

Fen – treed (wetland treed)

Photograph 10. Fen - treed community. Site B-5.

Photograph 11. Fen - treed community. Site B-5.

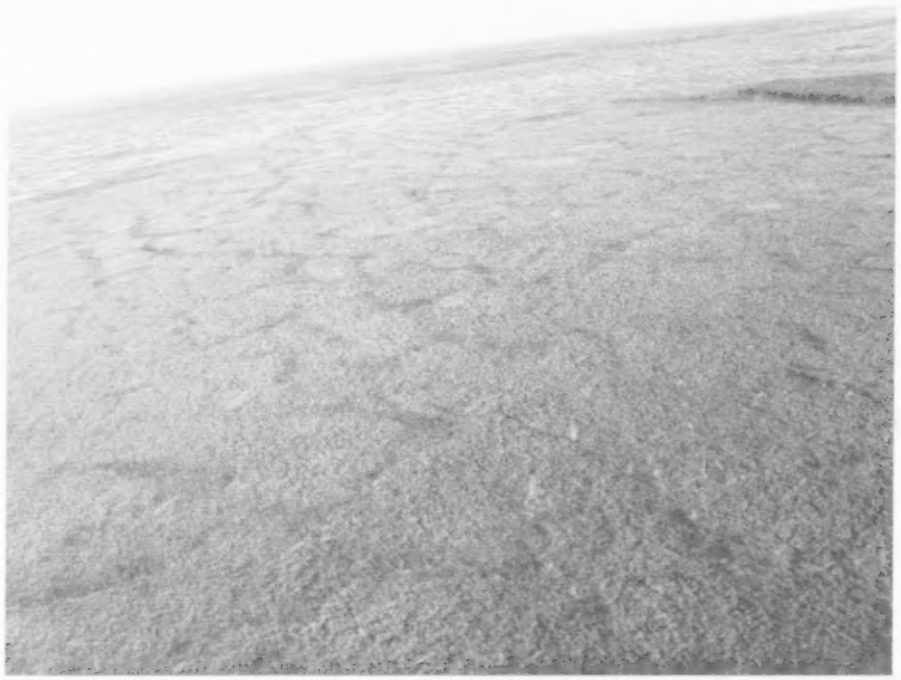
Fen – shrub (wetland shrub)

Photograph 12. Fen - shrub community. Site BL-13.

Photograph 13. Fen - shrub community from the air.

Fen – graminoid (wetland herb)

Photograph 14. Fen - graminoid community. Site BL-14.



Photograph 15. Fen - graminoid community from the air.

Jack pine closed canopy (coniferous dense)

Photograph 16. Young Jack pine closed canopy community. Site BL-12.

Photograph 17. Young jack pine closed canopy community from the air.

White spruce closed canopy (coniferous dense)

Photograph 18. White spruce closed canopy community. Site BL-9.

Photograph 19. White spruce open canopy community. Site B-6.

Photograph 20. White spruce open canopy community from the air.

Black spruce open canopy (coniferous open)

Photograph 21. Black spruce open canopy community. Site BL-1.

Photograph 22. Black spruce open canopy community. Site B-7.

Photograph 23. Black spruce open canopy community from the air.

Mixed forest closed canopy (mixed wood dense)

Photograph 24. Mixed forest closed canopy community. Site B-3.

Photograph 25. Mixed forest closed canopy community. Site BL-4.

Photograph 26. Mixed forest closed canopy community. Site BL-8.

Photograph 27. Mixed forest closed canopy community from the air.

Marsh

Photograph 28. Marsh community. Site BL-11.

Photograph 29. Marsh community. Site BL-16.

Photograph 30. Marsh community from the air.

APPENDIX C. Songbirds (Order: Passeriformes) known to occur or hypothetically occur in and within 200 km of the Buffalo Lake, River, and Trails Candidate Area.

Common Name	Scientific Name	Family	NWT GSRank[1]	COSEWIC Status	Detected during Field Work
Cedar waxwing	*Bombycilla cedrorum*	Bombycillidae	Secure		
Bohemian waxwing	*Bombycilla garrulus*	Bombycillidae	Secure		Yes
Rose-breasted grosbeak	*Pheucticus ludovicianus*	Cardinalidae	Secure		Yes
Snow bunting	*Plectrophenax nivalis*	Calcariidae	Secure		Yes
American crow	*Corvus brachyrhynchos*	Corvidae	Secure		Yes
Common raven	*Corvus corax*	Corvidae	Secure		Yes
Gray jay	*Perisoreus canadensis*	Corvidae	Secure		Yes
Black-billed magpie	*Pica hudsonia*	Corvidae	Secure		Yes
Le Conte's sparrow	*Ammodramus leconteii*	Emberizidae	Secure		Yes
Nelson's sparrow	*Ammodramus nelsoni*	Emberizidae	Undetermined		
Dark-eyed junco	*Junco hyemalis*	Emberizidae	Secure		Yes
Swamp sparrow	*Melospiza georgiana*	Emberizidae	Secure		Yes
Lincoln's sparrow	*Melospiza lincolnii*	Emberizidae	Secure		Yes
Song sparrow	*Melospiza melodia*	Emberizidae	Undetermined		
Savannah sparrow	*Passerculus sandwichensis*	Emberizidae	Secure		Yes
Fox sparrow	*Passerella iliaca*	Emberizidae	Secure		Yes
Vesper sparrow	*Pooecetes gramineus*	Emberizidae	Undetermined		Yes
American tree sparrow	*Spizella arborea*	Emberizidae	Sensitive		
Clay-coloured sparrow	*Spizella pallida*	Emberizidae	Undetermined		Yes
Chipping sparrow	*Spizella passerina*	Emberizidae	Secure		Yes
White-throated sparrow	*Zonotrichia albicollis*	Emberizidae	Sensitive		Yes
White-crowned sparrow	*Zonotrichia leucophrys*	Emberizidae	Secure		Yes
Common redpoll	*Acanthis flammea*	Fringillidae	Secure		Yes
Hoary redpoll	*Acanthis hornemanni*	Fringillidae	Undetermined		
Purple finch	*Carpodacus purpureus*	Fringillidae	Secure		

Common Name	Scientific Name	Family	NWT GSRank[1]	COSEWIC Status	Detected during Field Work
Evening grosbeak	*Coccothraustes vespertinus*	Fringillidae	Secure		
Red crossbill	*Loxia curvirostra*	Fringillidae	Secure		
White-winged crossbill	*Loxia leucoptera*	Fringillidae	Secure		
Pine grosbeak	*Pinicola enucleator*	Fringillidae	Secure		
Pine siskin	*Spinus pinus*	Fringillidae	Secure		Yes
Barn swallow	*Hirundo rustica*	Hirundinidae	Sensitive		
Cliff swallow	*Petrochelidon phyrrhonota*	Hirundinidae	Secure		Yes
Bank swallow	*Riparia riparia*	Hirundinidae	Secure		Yes
Tree swallow	*Tachycineta bicolor*	Hirundinidae	Secure		Yes
Violet-green swallow	*Tachycineta thalassina*	Hirundinidae	Undetermined		
Red-winged blackbird	*Agelaius phoeniceus*	Icteridae	Secure		Yes
Rusty blackbird	*Euphagus carolinus*	Icteridae	Sensitive	Special Concern	
Brewer's blackbird	*Euphagus cyanocephalus*	Icteridae	Undetermined		
Brown-headed cowbird	*Molothrus ater*	Icteridae	Secure		
Common grackle	*Quiscalus quiscula*	Icteridae	Secure		
Northern shrike	*Lanius excubitor*	Laniidae	Secure		
Black-capped chickadee	*Poecile atricapillus*	Paridae	Secure		Yes
Boreal chickadee	*Poecile hudsonica*	Paridae	Sensitive		Yes
Bay-breasted warbler	*Dendroica castanea*	Parulidae	Secure		
Yellow-rumped warbler	*Dendroica coronata*	Parulidae	Secure		Yes
Magnolia warbler	*Dendroica magnolia*	Parulidae	Secure		Yes
Palm warbler	*Dendroica palmarum*	Parulidae	Secure		Yes
Yellow warbler	*Dendroica petechia*	Parulidae	Secure		Yes
Blackpoll warbler	*Dendroica striata*	Parulidae	Sensitive		Yes
Cape May warbler	*Dendroica tigrina*	Parulidae	Secure		Yes
Common yellowthroat	*Geothlypis trichas*	Parulidae	Secure		Yes
Black-and-white warbler	*Mniotilta varia*	Parulidae	Secure		

Common Name	Scientific Name	Family	NWT GSRank[1]	COSEWIC Status	Detected during Field Work
Orange-crowned warbler	*Oreothlypis celata*	Parulidae	Secure		Yes
Tennessee warbler	*Oreothlypis peregrina*	Parulidae	Secure		Yes
Northern waterthrush	*Parkesia noveboracensis*	Parulidae	Secure		Yes
Ovenbird	*Seiurus aurocapillus*	Parulidae	Secure		Yes
American redstart	*Setophaga ruticilla*	Parulidae	Secure		Yes
Wilson's warbler	*Wilsonia pusilla*	Parulidae	Secure		Yes
House sparrow	*Passer domesticus*	Passeridae	Exotic/Alien		
Ruby-crowned kinglet	*Regulus calendula*	Regulidae	Secure		Yes
Golden-crowned kinglet	*Regulus satrapa*	Regulidae	Undetermined		
Red-breasted nuthatch	*Sitta canadensis*	Sittidae	Secure		
European starling	*Sturnus vulgaris*	Sturnidae	Exotic/Alien		
Western tanager	*Piranga ludovicana*	Thraupidae	Secure		Yes
Marsh wren	*Cistothorus palustris*	Troglodytidae	Undetermined		Yes
Winter wren	*Troglodytes hiemalis*	Troglodytidae	Secure		
Hermit thrush	*Catharus guttatus*	Turdidae	Secure		Yes
Gray-cheeked thrush	*Catharus minimus*	Turdidae	Secure		
Swainson's thrush	*Catharus ustulatus*	Turdidae	Secure		Yes
Varied thrush	*Ixoreus naevius*	Turdidae	Undetermined		
Townsend's solitaire	*Myadestes townsendi*	Turdidae	Secure		
American robin	*Turdus migratorius*	Turdidae	Secure		Yes
Olive-sided flycatcher	*Contopus cooperi*	Tyrannidae	At Risk	Threatened	Yes
Western wood-pewee	*Contopus sordidulus*	Tyrannidae	Secure		
Alder flycatcher	*Empidonax alnorum*	Tyrannidae	Secure		Yes
Yellow-bellied flycatcher	*Empidonax flaviventris*	Tyrannidae	Secure		
Least flycatcher	*Empidonax minimus*	Tyrannidae	Secure		
Eastern phoebe	*Sayornis phoebe*	Tyrannidae	Secure		Yes
Eastern kingbird	*Tyrannus tyrannus*	Tyrannidae	Secure		
Warbling vireo	*Vireo gilvus*	Vireonidae	Secure		Yes

Common Name	Scientific Name	Family	NWT GSRank[1]	COSEWIC Status	Detected during Field Work
Red-eyed vireo	*Vireo olivaceus*	Vireonidae	Secure		
Philadelphia vireo	*Vireo philadelphicus*	Vireonidae	Undetermined		
Blue-headed vireo	*Vireo solitarius*	Vireonidae	Secure		Yes

[1] ENR General Status Ranking 2011.

APPENDIX D. Waterfowl known to occur or hypothetically occur in and within 200 km of the Buffalo Lake, River, and Trails Candidate Area.

Common Name	Scientific Name	Order	Family	NWT GSRank [1]	COSEWIC Status	Detected during Field Work
Northern pintail	*Anas acuta*	Anseriformes	Anatidae	Sensitive		Yes
American widgeon	*Anas americana*	Anseriformes	Anatidae	Secure		Yes
Northern shoveler	*Anas clypeata*	Anseriformes	Anatidae	Secure		Yes
Green-winged teal	*Anas crecca*	Anseriformes	Anatidae	Secure		Yes
Blue-winged teal	*Anas discors*	Anseriformes	Anatidae	Secure		Yes
Mallard	*Anas platyrhynchos*	Anseriformes	Anatidae	Secure		Yes
Gadwall	*Anas strepera*	Anseriformes	Anatidae	Undetermined		
Greater white-fronted goose	*Anser albifrons*	Anseriformes	Anatidae	Secure		
Lesser scaup	*Aythya affinis*	Anseriformes	Anatidae	Sensitive		Yes
Redhead	*Aythya americana*	Anseriformes	Anatidae	Secure		
Ring-necked duck	*Aythya collaris*	Anseriformes	Anatidae	Secure		Yes
Greater scaup	*Aythya marila*	Anseriformes	Anatidae	Secure		
Canvasback	*Aythya valisineria*	Anseriformes	Anatidae	Secure		Yes
Canada goose	*Branta canadensis*	Anseriformes	Anatidae	Secure		Yes
Bufflehead	*Bucephala albeola*	Anseriformes	Anatidae	Secure		Yes
Common goldeneye	*Bucephala clangula*	Anseriformes	Anatidae	Secure		Yes
Long-tailed duck	*Clangula hyemalis*	Anseriformes	Anatidae	Sensitive		Yes
Trumpeter swan	*Cygnus buccinator*	Anseriformes	Anatidae	Sensitive	Not at Risk	Yes
Hooded merganser	*Lophodytes cucullatus*	Anseriformes	Anatidae	Secure		
White-winged scoter	*Melanitta fusca*	Anseriformes	Anatidae	Sensitive		
Black scoter	*Melanitta americana*	Anseriformes	Anatidae	Sensitive		
Surf scoter	*Melanitta perspicillata*	Anseriformes	Anatidae	Sensitive		Yes
Common merganser	*Mergus merganser*	Anseriformes	Anatidae	Secure		Yes
Red-breasted merganser	*Mergus serrator*	Anseriformes	Anatidae	Secure		Yes
Ruddy duck	*Oxyura jamaicensis*	Anseriformes	Anatidae	Secure		

Common Name	Scientific Name	Order	Family	NWT GSRank [1]	COSEWIC Status	Detected during Field Work
Common loon	*Gavia immer*	Gaviiformes	Gaviidae	Secure	Not at Risk	Yes
Pacific loon	*Gavia pacifica*	Gaviiformes	Gaviidae	Secure		Yes
Red-throated loon	*Gavia stellata*	Gaviiformes	Gaviidae	Secure		Yes
Horned grebe	*Podiceps auritus*	Podicipediformes	Podicipedidae	Sensitive	Special Concern	Yes
Red-necked grebe	*Podiceps grisegena*	Podicipediformes	Podicipedidae	Secure	Not at Risk	Yes
Eared grebe	*Podiceps nigricollis*	Podicipediformes	Podicipedidae	Vagrant/Accidental		
Pied-billed grebe	*Podilymbus podiceps*	Podicipediformes	Podicipedidae	Sensitive		

[1] ENR General Status Ranking 2011.